SANYO GALLENKAMP

ENVIRONMENTAL CHAMBER

INSTRUCTION MANUAL

Customer	B. de Ronde
Programming system	Format 550 Programmer
Cabinet model supplied:	HCC065.PF4.J
Cabinet reference:	7904
Handbook date:	July 1994
Handbook reference:	SG7904/Z01456

CONTENTS PART ONE - THE CABINET

Section

FORMAT 550 CONTROLLER OPERATING INSTRUCTIONS

Full instructions for operating the Format 550 controller are given in the second part of this manual. The contents list is provided at the beginning of that part

1. INTRODUCTION

Great care has been taken in the specification, design and manufacture of your cabinet, to provide a system that will give long dependable service.

This handbook is an integral part of that policy. Please use it to help you obtain continued good performance and reliability. If it fails, please let us know.

1.1. Health & Safety at Work

Section 6 (4) of the above act requires manufacturers to advice their customers on the operating and handling precautions to be observed when installing, operating, maintaining and servicing their products. Accordingly, the following points should be noted.

1. The relevant sections of these instructions should be carefully read before proceeding.
2. Intallation, maintenance and servicing should only be carried out by suitably trained personnel.
3. Normal safety procedures must be taken to avoid the possibility of an accident occurring.

1.2. Commissioning (U.K. Customers only)

If required, we can arrange for one of our engineers to commission the cabinet. In many cases this is not necessary but should you feel that his services are required please telephone us at Loughborough to make the necessary arrangements. During his visit our engineer will run the cabinet and check that its systems are functioning correctly.

Take advantage of the commissioning visit to ensure that your staff are fully acquainted with the cabinet and its operation.

1.3. Sanyo Gallenkamp service & maintenance facilities

Sanyo Gallenkamp's Service Engineers and their colleagues have many years of experience in this equipment. This expertise is readily available, either as diagnostic advice or on-site attendance.

Sanyo Gallenkamp Service Department operates nationally from our Loughborough factory, where all stocks of spares are held. In addition to training of customers own engineers for first line maintenance, we offer:

1. Extended warranty (2 years)
2. Contract maintenance schemes
3. 24 hour response/call out

A loan or hire of units can be arranged in circumstances where an immediate repair is not possible.

2. CABINET DATA

2.1. SPECIFICATION - PHYSICAL

model size	90	195	310	600	650	1100	2000
Internal working dimensions (mm):							
width	450	650	680	650	900	1100	2000
depth	450	500	650	650	900	1000	1000
height	450	600	700	1400	800	1000	1000
External dimensions (mm):							
(excluding protrusions)							
width	1144	1304	1334	1320	1554	1904	2654
depth	710	840	990	850	1240	1340	1340
height	113	1730	1875	1960	1975	1845	1975
Capacity (litres):	90	195	310	600	650	1100	2000
Shelf loading maximum kg:	10	10	15	10	20	30	30
Cabinet loading maximum kg:	30	30	45	50	60	90	90
Distilled water usage litres/hr:	not specified						
Gross weight approx kg:	180	280	310	320	360	750	900

Electrical requirement:

as stated on the cabinet rating plate (380/440V 50Hz 3ph or 216/264V 50Hz 1ph)

Refrigeration gas: CFC - free

2.1.1 Construction

Interior

High quality stainless steel welded and vapour sealed.

Exterior/finish

Zinc coated mild steel with a stoved acrylic, textured finish. The interior surfaces of the mild steel are protected with rubberised paint and sealed against the ingress of moisture.

Insulation

Minimum of 75mm of polyurethane foam/glass wool.

Access

Full sized insulated outer door with silicone rubber seal.

If fitted, full sized inner glass door with silicone rubber seal.

One or more 66mm diameter silicone rubber cable entry port in left hand wall.

Shelf

One solid stainless steel shelves with three shelf positions.

All models have a double skinned working chamber base which can be used for test samples.

False roof

Provided to prevent condensate droplets from falling on the test samples.

Castors

Nylon castors are fitted to floor standing models; front castors are lockable.

Drain

Provided for drainage of excess moisture.

Vent

Provided in the rear of the cabinet to allow for expansion and contraction during temperature changes.

Can also be used, in conjunction with the cable port, to provide air exchange to prevent the build up of humidity or contaminating gases from test samples.

2.2. SPECIFICATION - PERFORMANCE

Model reference	**CF1**	**CF4**	**CF7**
Temperature range:	-10°C to +180°C	-40°C to +180°C	-70°C to +180°C

models HCC009.CB1 and HCC060.CF1 have a T°max of 100°C

Temperature rise rate	not specified
Temperature fall rate	not specified
Temperature fluctuation (with time)	0.3°C
Temperature variation (gradient)	1.0°C

Humidity range % rh	20°C	30°C	60°C
	50-95	30-95	15-95

Humidity fluctuation (with time)	at max rh:	3% rh
	at min rh:	5% rh

Air velocity (average, empty working chamber) 0.2 m/sec (turbulent)

Tolerated cabinet loadings to maintain specified performance

Static load (ie the test load):	not specified
Dynamic load watts (ie dissipating loads):	not specified

Fluctuation is the maximum difference (temperature or humidity), measured at the chamber centre, over a period of time, after the cabinet has reached stability.

Variation is the maximum temperature difference, at any time, between the centre of the chamber and the extremes of the working envelope.

2.3. OPTIONAL FACILITIES

Where optional facilities are fitted to the cabinet instructions for their use, if necessary, are detailed in the appendices of this manual. Alternatively, additional information sheets are inserted in the front of this manual.

2.4. FORMAT 550 DIGITAL CHANNELS

The Format 550 programming system fitted to the cabinet has the following digital channel functions. A number of the channels are for the control of the cabinet and are usually automatically selected on or off by the programmer as required to achieve particular conditions. If applicable, other user designated channels are also detailed below. All digital channels are shown on the monitor and program screens of the Format 550 programmer.

Full operating instructions for the Format 550 programmer are given in Part 2 of this manual.

DIGITAL CHANNEL 1 COOLING (MAIN)

SYSTEM CHANNEL

This channel switches the main cooling mode on (see section 3.2). The main cooling mode is used to:

a) enable programmed temperature pull down from +70°C, ie: the fall rate is controlled.

b) enable freefall temperature pull down from the cabinet's maximum temperature, ie: the fall rate is as fast as possible.

c) enable temperature dwells below +40°C (auxiliary cooling is used between +40°C and +15°C if high humidity control is required).

d) extract heat dissipated from the test load between +70°C and the minimum operating temperature.

e) enable the cooling coil's low surface temperature to dehumidify the cabinet between +5°C and +70°C.

DIGITAL CHANNEL 2 COOLING (AUXILIARY)

SYSTEM CHANNEL

This channel switches the auxiliary cooling mode on. The indirect cooling mode is used to:

a) control temperature dwells with high humidities between approx. +15°C and +60°C.

b) extract heat dissipated from the test load during temperature dwells. The capacity of the auxiliary cooling mode to extract heat from the test load is limited.

DIGITAL CHANNEL 4 HUMIDIFIER (VPG)

SYSTEM CHANNEL

This channel determines when "steam" injection from the vapour phase generator system is available to the program controller.

This channel is always enabled when a humidity setting is programmed into the Format 550 programmer.

DIGITAL CHANNEL 8 VOLTAGE FREE TERMINAL (VFT)

USER PROGRAMMABLE CHANNEL

This channel enables the switching of external devices, such as measuring equipment, and the test load.

The system comprises of a voltage free termination of the programmer's digital channel number 8 which is wired through the cabinet's safety thermostat. The final termination is a socket on the side or rear of the instrument compartment (a suitable plug is provided). The termination is rated at 240v 5A maximum and requires a suitable circuit for switching higher current loads.

Program this channel ON whenever the voltage free termination is required to be "closed contact".

3.DESCRIPTION

3.1. PRINCIPLE AND AIRFLOW

The well insulated cabinet interior is divided into working and treatment chambers, as shown in the diagram (fig.1). Air is circulated by a fan from the treatment (conditioning) chamber into the working chamber through the right hand wall plenum in which the wet and dry bulb sensing elements are situated in the optimum position for rapid response. The conditioned air passes through the working chamber in a turbulent manner, ensuring minimum temperature gradients, before returning to the treatment chamber through the left hand wall plenum.

All performance tolerances are to within 50mm of the walls of the working chamber. This is the working envelope in which the test load is not affected by heat sources such as fans, heaters or cooling coils.

The temperature and relative humidity of the air are maintained at the conditions set by the operator via the control system. A sloping false roof is fitted to the working chamber to prevent condensation dripping onto the test load. The base of the working chamber is double skinned to prevent hot and cold "spots" forming due to radiated heat/cold from the treatment chamber. If required, the base of the working chamber may be used as another shelf.

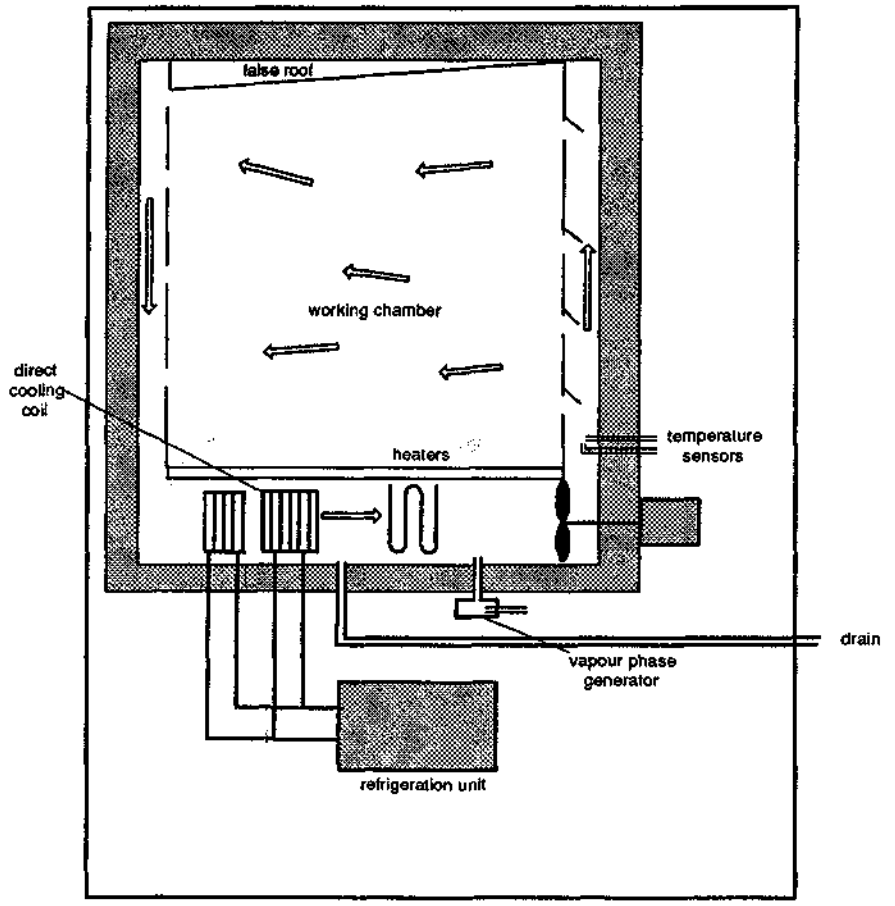


Figure 1

3.2. TEMPERATURE CONTROL

Accurate, repeatable temperature control levels are achieved by continuously balancing heat loss with intermittent modulated heating controlled by electronic controllers.

The conditioned air flows over a dry platinum resistance temperature sensor (BS1904, 100ohms at 0°C) which feeds signals back to an electronic controller. The actual temperature is compared with the operator set temperature and errors are corrected by switching the heaters via relays on a time proportioning basis to achieve smooth accurate control.

3.2.1 HEATING

One or more "Inconel" sheathed electrical heating elements are situated in the treatment area. These elements normally operate only at black heat, for a long life and avoidance of excessive heater surface temperatures.

3.2.2 COOLING

All models have CFC-free mechanical refrigeration units with a direct cooling coil to achieve the minimum temperature specified

All refrigeration compressors are protected for operation at working chamber temperatures up to +70°C.

Cabinets with a -70°C lower temperature limit (CF7 models) use cascade refrigeration systems.

The main and auxiliary cooling modes are automatically selected by the control system to enable:

a) freefall temperature pull-downs from the cabinets maximum temperature, ie the fall rate is as fast as possible down to +70°C or below.

b) temperature dwells below +40°C (auxiliary cooling is used between +40°C and +15°C if high humidity control is required).

c) extraction of heat dissipated from the test load between +70°C and the minimum operating temperature.

d) the cooling coil's low surface temperature to dehumidify the cabinet between +5°C and +70°C.

Refrigeration unit control

The refrigerator is controlled by the switching of solenoid valves which pass refrigerant to pressure switches, which in turn energise the refrigerator compressor motor. There is a short delay between switching and motor start up. Similarly, pressure switches act as safety devices, preventing excessive pressure which might arise when the refrigerator is not selected, and the refrigerant is heated by the cabinet. In such cases, the pressure switches detect the incipient pressure rise and switch on the compressor to "pump down".

3.3. RELATIVE HUMIDITY (RH)

Relative humidity is a measure of the ratio of the amount of water vapour present in an atmosphere to the amount of water vapour that atmosphere could hold, ie. the humidity present relative to the humidity possible. The latter varies with temperature, hence RH measurements are related to their prevailing temperature. Air at 100% relative humidity is saturated and cannot absorb any more water. If air at 100% rh is heated, the amount of water the air can hold increases and therefore the %rh will drop unless more water is introduced. If air at 100% rh is cooled, water will be lost through condensation on to the cooling surface.

For each atmospheric RH/temperature relationship there is another relevant temperature, known as the dew point. Surfaces at or below this temperature chill the water vapour sufficiently to cause condensation.

3.3.1 RELATIVE HUMIDITY DETERMINATION

Air with a relative humidity less than 100% flowing over a wet surface causes evaporation of water from that surface and causes a temperature drop at the surface. The actual drop in temperature compared with the temperature of a similar dry surface subjected to the same air flow can be used to measure and control relative humidity. The technique is known as "wet & dry bulb psychrometry" and the difference in temperature is referred to as the "wet bulb depression". Psychrometric tables give interrelated values for temperature, relative humidity and wet bulb depression.

In the cabinet, conditioned air flows over two resistance thermometer (RT) sensors, one dry and one kept permanently wet by a wick fed from a constant level water reservoir. The RT's are connected to the programmer. The relative humidity is determined from the psychrometric difference between the wet and dry RT's. The reference temperature for humidity control is compensated for the actual chamber temperature. Errors are corrected by actuating the vapour phase generator (vpg).

3.3.2 RELATIVE HUMIDITY CONTROL

Relative humidity levels are maintained by balancing continuous, minimised, extraction of water by condensation with intermittent injection controlled by an electronic controller.

3.3.3 RELATIVE HUMIDITY INCREASE

All cabinets are fitted with a vapour phase generator (VPG).

Vapour phase generation

Water vapour produced in the vpg is introduced into the treatment chamber and is absorbed by the air.

The vapour phase generator is provided humidification from 15% to 95% rh at 60°C to 50 to 95% at 20°C.

3.3.4 RELATIVE HUMIDITY DECREASE

Dehumidification is achieved using the cooling coil to form a dew point to remove water vapour from the air in the working chamber.

The direct cooling mode has a low surface temperature cooling coil which enables dehumidification of the cabinet air between +5°C and +70°C.

4.INSTALLATION

4.1. ACCESSORIES & SPARES

Check that the following items have been supplied with the cabinet.

a) Wick for the wet bulb sensor(s)

b) A set of psychrometric tables for the recorder (if fitted)

c) Instructions and wick for recorder (if fitted)

4.2. POSITIONING

4.2.1 Cabinets not requiring on-site commissioning

Place the cabinet on a level site, or suitable surface in the case of bench standing models, in such a position that air is free to circulate around it. The cabinet should be placed at least 450mm (18ins) away from any obstruction, eg: a wall or workbench.

For floor standing models lock the front castors to prevent movement.

Stand the cabinet in its operating position for 24 hours before switching on, to allow oil in the refrigeration system to return to sump. If the cabinet is moved, allow it to stand again.

If required, we can arrange for one of our engineers to commission the cabinet. Should you feel that his services are required please telephone us at Loughborough to make the necessary arrangements. During his visit our engineer will run the cabinet and check that its systems are functioning correctly and enable you assure that your staff are fully acquainted with the cabinet and its operation.

4.2.2 Cabinets requiring on-site commissioning

Cabinets supplied with a separate or remote refrigeration unit should be positioned to enable the pipe and cable connections to be made by our service engineer. Positioning must be on a level site such that the cabinet and refrigeration unit are at least 450mm (18 ins) away from any obstruction, eg: a wall or workbench. Lock the front castors to prevent movement.

During his visit our engineer will run the cabinet and check that its systems are functioning correctly. Take advantage of the commissioning visit to ensure that your staff are fully acquainted with the cabinet and its operation.

Connect a suitable power supply to the cabinet (see section 4.4). The maximum power ratings are shown on the cabinet rating plate (and refrigeration unit rating plate, if applicable).

DO NOT SWITCH ON THE CABINET UNTIL IT HAS BEEN COMMISSIONED.

Figure 2

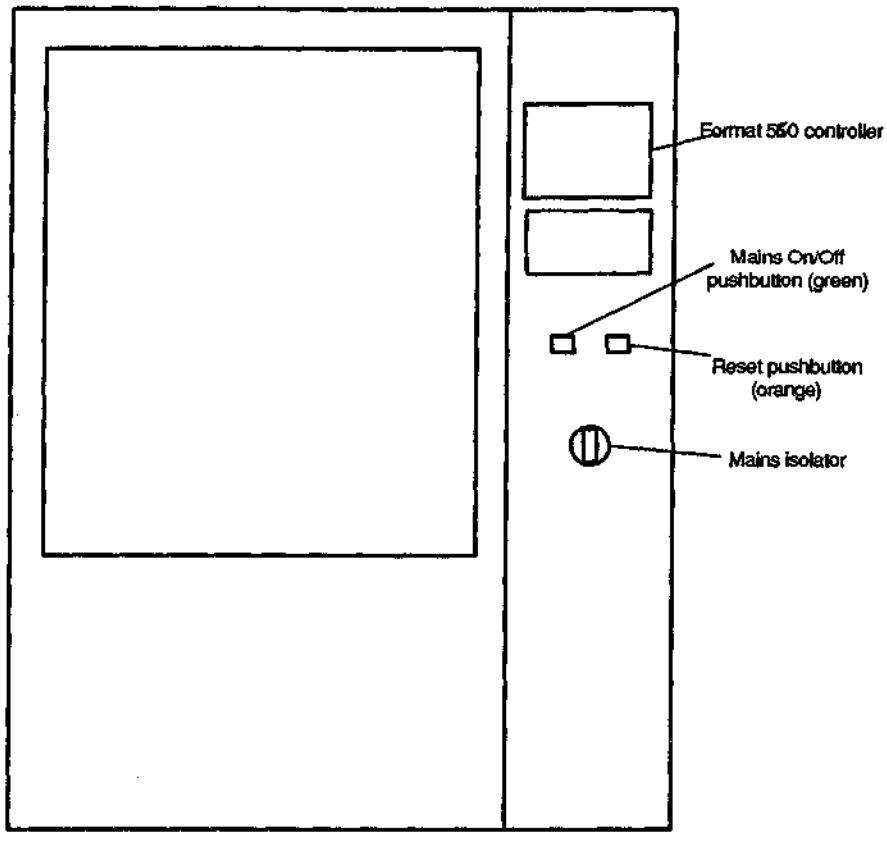
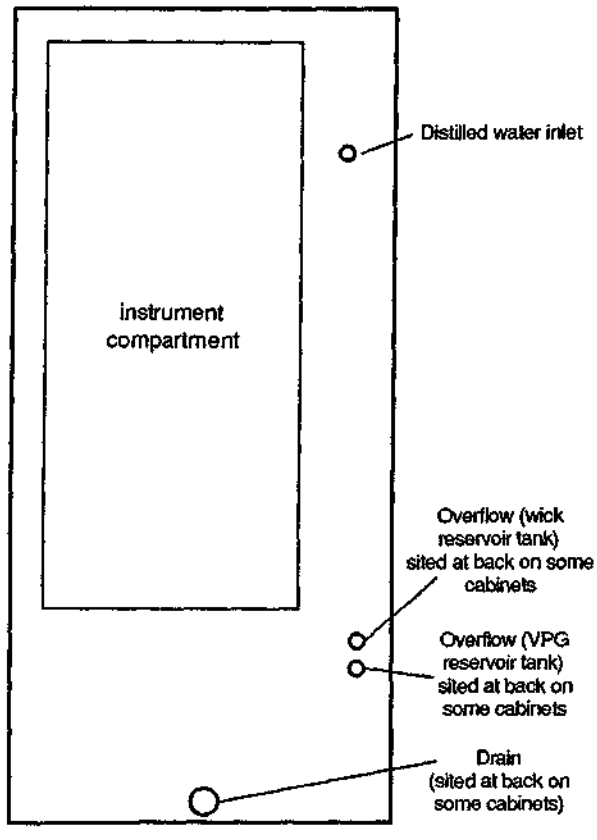


Figure 3



4.3. AMBIENT TEMPERATURE

IMPORTANT

To achieve the guaranteed performance figures, the maximum acceptable laboratory ambient temperature is +25°C. At higher ambient temperatures, the minimum operating temperature and rate of fall will be affected.

All refrigeration equipment, from home freezers to air-conditioning plant, performs a heat exchange operation in which the refrigeration compressor acts as a heat pump to transfer heat from the cooling coil (called the evaporator because this is where the gas evaporates and absorbs heat) to the condensing coil (where the gas condenses and gives up heat). The condensing coil is air-cooled, and assisted by a fan.

All air-cooled condensers need air movement around them in order to be able to give up to the air the heat extracted from the cooling coil (and hence the cabinet).

If the ambient temperature is high (above +25°C) more air will be required around the condenser to take up the same amount of heat. At the same time the higher ambient temperature transfers heat more quickly into the cabinet through the insulation, giving the refrigeration unit more work to do to maintain low temperature conditions.

Excessively high ambient temperatures and poor ventilation will cause the refrigerator compressor to overheat and inevitably reduce its working life - possibly even causing it to burn out.

4.4. POWER SUPPLY

Cabinets designed for operation from a 13A supply are supplied with a 13A plug fitted.

Cabinets not supplied with a 13A plug are required to be hard wired by a competent electrician to an adequate power supply by connection to the front panel power contactor. Power requirements are shown on a plaque on the rear of the cabinet, The supply frequency is 50Hz, unless stated otherwise. An EARTH connection is essential to all chamber. In addition, if the chamber requires a 3 phase supply NEUTRAL is also required.

WARNING

If the cabinet requires on-site commissioning do not switch on until it has been fully commissioned, see section 4.2.2.

4.5. MAINS INTERRUPT BRIDGE

If the power supply to the cabinet fails for up to 30 seconds, the cabinet will restart and continue the program from where it left off. However if the power supply interruption lasts longer than approx 30 seconds the cabinet will fail-safe.

4.6. DRAIN

An outlet nipple (usually copper pipe) is fitted to the cabinet (right hand side or back). Connect a pipe to give a CONTINUOUS FALL to an OPEN DRAIN. Drainage restriction could cause an airlock and consequent flooding of the treatment chamber.

Two small black plastic pipes are also fitted to the right hand side or rear of the cabinet. These are overflows from the wick reservoir and vpg humidification system self levelling header tanks. If a float valve develops a fault, the respective overflow will operate preventing flooding of the instrument compartment.

4.7. DISTILLED WATER SUPPLY

EITHER

Connect the distilled water supply to inlet connector situated on the right side or at the rear of the cabinet. Maximum allowable head is 1500mm (5ft) above the inlet.

It is safe for a container to stand on top of the cabinet, but ideally any reservoir should have its own support to one side of the cabinet.

OR

If the cabinet is supplied with a water re-circulating system, fill the reservoir as instructed and connect the water connections to the cabinet water inlet and drain as shown..

4.8. WET WICK(S)

(See Section 6.2.4 wet wicks)

Wet bulb sensor(s) must be fitted with wet wick(s).

Anchor the wick in the water reservoir and then push it over the sensor. The wick should be taut but not stretched. The sensor must be completely covered. If any part of the sensor is uncovered or protrudes through the weave then accuracy will be impaired.

Keep wick material clean. Contamination affects absorbency and hence RH control.

4.9. TEST LOAD PROTECTION

A safety thermostat should be fitted to all equipment being powered inside the cabinet. The thermostat should switch off equipment power if the air temperature in the cabinet rises above safety level.

The thermostat will protect both the equipment and the cabinet against damage in the event of failure or shut down of the cabinet's temperature control system. Equipment dissipating only a few hundred watts inside the well insulated cabinet, with no cooling, will heat sufficiently to cause severe damage.

Advice on suitable thermostats is available from our Technical Department.

SANYO GALLENKAMP will not be held responsible for any damage to either equipment or cabinet, during or after the cabinet guarantee period, caused by heat dissipation from unprotected equipment.

If the cabinet is fitted with a glass inner door and the load being tested in the cabinet is liable to dissipate excessive heat, the glass inner door must be protected from absorbing this heat by radiation effect. Failure to protect the inner door could result in the glass cracking.

4.10. CABLE PORT

One or two cable portis are fitted to the left hand side of the cabinet to enable wires/leads etc to pass into and out of the cabinet. The port has two plugs, one inside, one outside the cabinet and both plugs must be fitted when the cabinet is in operation to maintain the cabinets excellent insulation. The plugs can be slit or holes bored to enable wires/leads to pass through the port. Wires/leads should enter the cabinet via the top of the outside plug and the bottom of the inside plug to prevent condensation accumulating between the plugs. Extra or replacement plugs can be obtained, see PART NUMBERS

4.11. VENT

An air vent is situated at the rear of the cabinet. The hole in the vent must always be kept clear as it prevents pressurisation of the cabinet.

4.12. GLASS INNER DOOR

When fitted, a glass inner door enables observation of the test without unduly disturbing the cabinet's climatic conditions. The door is held closed by sash fasteners which should be hand tight and not forced.

If the test load dissipates heat, the glass door must be protected from absorbing heat by radiation effect, see section 3.8 Test load protection.

4.13. RS232 CONNECTOR

On the right hand side of the instrument compartment is the 25 pin "D" type RS232 serial communications connector of the Format 550 programmer. Further details of the pin connections are given in Part 2 of this manual.

4.14. SAFETY THERMOSTAT

A factory preset safety thermostat is fitted inside the instrument compartment to protect against overheating of the cabinet in the event of failure of the temperature control system.

The thermostat is set to a temperature 10°C above the maximum operating specification of the cabinet. The thermostat must not be reset.

Should the cabinet air temperature exceed that set on this thermostat it will cause the cabinet to fail-safe, i.e. shutdown automatically.

N.B.this thermostat monitors the cabinet only - see also 4.9 - Test load protection.

5.OPERATION

WARNING

This cabinet is capable of temperatures well outside ambient. If the door is opened during such conditions there could be a temperature HAZARD from cabinet air or contents.

5.1. CONTROL PANEL INSTRUMENTATION

Full details of the Format 550 programmer/controller fitted to the cabinet are given in Part 2.

If there are any further controls not mentioned here, refer to 2.3 - Additional facilities fitted.

5.1.1 INDICATORS/PUSHBUTTONS

Mains **Green indicator lamp**

The mains indicator is illuminated green when mains power is supplied to the cabinet and the mains power switch (red/yellow rotary switch) is switched on.

Reset **Amber pushbutton**

Internal lamp glows whenever the cabinet is powered but not reset. Press to reset and start the cabinet. The reset button is not illuminated when the cabinet is running.

5.1.2 RECORDER

If a recorder is fitted it should be set up and operated in accordance with the manufacturer's instructions, packed either with this manual or inside the instrument itself.

5.2. CABINET AND PROGRAM START UP

Ensure that:

a) The interior of the cabinet is clean and dry.

b) You know how to SHUT DOWN the cabinet (see section 5.4).

c) Distilled water level is adequate

d) Clean wicks are fitted to the wet bulb sensor(s).

TO START THE CABINET:

a) Switch the MAINS red/yellow isolator fitted to the front control panel to ON. The MAINS pushbutton on the front control panel will become illuminated green.

b) Power is now available to the Format 550 controller and settings for required test or cycle are entered - see Part 2 of this manual for the Format 550 instructions..

c) Start manual control or the desired program.

d) Press and hold the RESET pushbutton until the cabinet starts. The reset orange indicator light will extinguish when the cabinet starts.

e) The Format 550 will now control the cabinet.

5.3. CABINET AND PROGRAM SHUT DOWN

TO SHUT DOWN THE CABINET - NORMAL SEQUENCE:

a) To terminate steady state or two setpoint cycling control - see Format 550 instructions.

b) When control by Format 550 has been completed or terminated switch the cabinet's red/yellow mains isolator to OFF. The cabinet conditions will now drift slowly to ambient.

EMERGENCY SHUT DOWN:

a) Switch the MAINS red/yellow isolator fitted to the front control panel to OFF.

6.MAINTENANCE AND CARE

WARNING

Before entry into the instrument compartment, refrigeration compartment, or treatment chamber ISOLATE THE CABINET FROM MAINS POWER unless otherwise stated.

The cabinet has been designed and built for a long life and requires minimal attention and maintenance. However, regular attention to the few points will ensure a long and trouble free life.

If the cabinet does fail, the expertise of our service engineers is readily available for either diagnostic advice or on-site attendance. Service contracts are available after the one year guarantee period finishes and details are available from our Service Department.

This section contains a maintenance schedule to follow and a methods section giving instructions relating to the schedule.

Note: If the cabinet is going to be left unused for more than a month, we suggest that the cabinet is started up and run through all its functions on a monthly basis. This will ensure that the cabinet is in perfect running order for when it is required.

6.1. MAINTENANCE SCHEDULE

Weekly or between tests

Clean the cabinet's interior and exterior surfaces
Clean drain(s)
Clean atomiser(s)
Check wicks

Monthly

Renew wicks
Lubricate moving parts
Check safety thermostat
Clean refrigerator condenser
Check distilled water filter

6.2. MAINTENANCE METHODS

6.2.1 Interior and exterior cleaning

The cabinet interior and exterior should be kept clean and free from deposits.

The exterior surface is easily cleaned with warm soapy water. When cleaning any stainless steel surface do **not** use any cleaning agent containing chloride or hypochlorite ions as these will cause corrosion.

6.2.2 Cleaning of cabinet drain(s)

Either one or two drains are situated centrally in the base of the treatment chamber. Access to the treatment chamber involves the removal of the working chamber base. Remove the front cover and slide out the working chamber base. Any accumulation of contaminants from the test sample can cause the treatment chamber to block. The drain should be checked regularly to ensure that particles are not collecting around it.

6.2.3 Inspection and replacement of the wet wick(s)

Access to the sensors and wicks is through the sliding panel in the right hand wall of the working chamber. See fig. 4 for the position of the wet and dry bulb sensors.

The accuracy of all wet and dry bulb systems for the control of relative humidity is totally dependent on the wet wick. The rate of evaporation from the wick determines the cooling of the sensor and hence the temperature differential (wet bulb depression) of the control or recording instrument. Adherence to the following notes is recommended for all serious work at controlled relative humidities.

a) Wick must be clean - handle with care and clean hands - store in a clean place - change regularly (once a month).

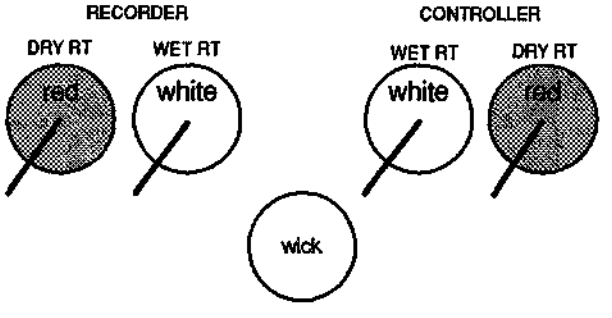
b) Wick must cover the entire exposed length of the sensor ie: extend well beyond the sensitive tip and fit tightly to the sensor.

c) Wick must be the correct length to fit over the sensor and well down into the rubber wick reservoir, to prevent the high speed, necessary for correct evaporation, from blowing the wick out of the reservoir.

d) If wicking quality of the material is suspect, test by cutting off 1 cm of dry material and dropping into a cup of distilled water. Sample should wet and sink within 2 seconds.

Often wicking quality can be restored by boiling for a few minutes in clean distilled water.

Figure 4.



Temperature sensor positions (as viewed from inside working chamber)

6.2.4 Lubrication

Most moving parts are lubricated and sealed for life except, the inner door catches (if glass inner door is fitted). These components should be oiled once per month

6.2.5 Check safety thermostat

Adjust the safety thermostat, sited inside the instrument compartment, through prevailing cabinet temperature. Check that the safety thermostat fails the cabinet safe. In the event of a fault RECTIFY AT ONCE.

6.2.6 Clean the refrigeration condenser

It is essential that the refrigeration condenser is kept clean - dirty condensers adversely affect the performance of the cabinet and reduce the working life of the refrigeration unit.

1. Isolate from MAINS

2. Remove the front louvre and back mesh panels from refrigeration compartment, or ventilation panels in the case of a separate refrigeration module.

3. Gently brush/blow/vacuum dust etc from the fins and tubes of the refrigerator condenser coil(s).

Initially check and clean the condenser monthly, actual frequency will depend upon the cleanliness of the surroundings.

6.2.7 Distilled water filter

This is located below the distilled water inlet nozzle and can be inspected through the viewing hole in the cabinet's side or back panel. The clear plastic bowl and filter can be removed for cleaning.

1. ISOLATE ELECTRICS

2. If recirculating water system is not fitted disconnect the distilled water supply.

3. Open instrument compartment door.

4. Unscrew the bowl and remove the filter. Clean or replace.

5. Reassemble in reverse order.

APPENDIX 1 PART NUMBERS

Part numbers will be provided separately

Note: some of the parts may not apply to your cabinet.

FAN MOTOR	
BUNG	66mm diameter
BUNG	100 diameter
ELEMENT	v.p.g. heater
ELEMENT	cabinet heater (primary)
ELEMENT	cabinet heater (secondary, if fitted)
MCB	
MCB	
MCB	
MCB	
RELAY	Delay
RELAY	Solid state (2.5 amps)
RELAY	Solid state (25 amps)
FILTER	Distilled water
SERVICE KIT	For air compressor
SOLENOID VALVE	Distilled water system
SENSOR	R.T.
WICK	For wet bulb, controller
WICK	For wet bulb, recorder
SAFETY THERMOSTAT	Mechanical

APPENDIX 2 REC/W - WATER SYSTEM

The recirculating water system is a self-contained unit. The system purifies waste water from the working chamber and recirculates it back to the cabinet inlet, removing the need for a continuous supply of distilled water. It consists of a reservoir tank, water, pump, deioniser cartridge and a purity indicator. Waste water is piped to the reservoir tank, then pumped through a deioniser cartridge and back to the cabinet inlet. The purity of the water in the system is indicated by either a conductivity meter or a colour change indicator window on the deioniser cartridge.

Installation

1) Place the recirculating water system below cabinet level (preferably beneath) to enable the water waste to drain back to the reservoir.

2) Connect the recirculating water unit inlet to the cabinet drain; then connect the recirculating water unit outlet to the cabinet water supply inlet. Suitable lengths of plastic tubing are provided. There must be a CONTINUOUS fall from the cabinet to the system inlet - otherwise the cabinet will flood due to air locks in the pipe.

3) Remove the white filler cap and fill the reservoir with DISTILLED water. Use distilled water because distillation kills algae spores.

4) Connect the mains lead to a 220/240 volt, 50Hz, single phase minimum 5A supply.

Operation

Switch on the mains power to operate the recirculating water system. To cease operation switch off the mains power.

If the level of water in the reservoir falls to the minimum mark, top-up with distilled water.

For units with the water purity indicated by a conductivity meter, calibrate the meter by pressing and holding in the button (left of the meter) and turning the knob (right of the meter) to adjust the meter to read infinity. A satisfactory reading for water conductivity is below 10 micro mho/cm. Above this level the deioniser cartridge requires replacement.

For units indicating water purity by a colour change indicator do not require calibration. A satisfactory water conductivity of below 10 micro Seimens/cm is indicated by a dark blue colour. The deioniser cartridge requires replacement if the indicator window colour changes to light brown.

The anticipated life of the deionisers in both systems is at least 6 months when used with distilled water and in clean' test conditions.

Maintenance

It is recommended that the water in the system is changed monthly, or after a test if longer, with distilled water. If the system is contaminated with inorganic products or substances likely to promote algal or bacterial growth, the water should be changed every 14 days. If contaminated with organic products change the water after every test.

System draining

Switch off the main power. Disconnect the pipe connected to the cabinet distilled water inlet and place in suitable vessel or floor drain. Switch on the system, the pump operates and pumps out the reservoir water. When the water ceases, switch off the power and reconnect the outlet pipe to the cabinet distilled water inlet. Fill the reservoir with distilled water to the level shown on the sight tube.

Deioniser replacement

Disconnect from mains power, drain the system as described above, and open the front panel of the unit. Both types of cartridges are then disconnected from the water pipes and a new cartridge connected. Refit the front panel and fill the system. The meter type system cartridge is returnable for regeneration. The colour change type cartridge is disposable. Refer to the Parts List for details.

PART 2 - FORMAT 550 INSTRUCTIONS

CONTENTS

Part number Z01456 Issue 6.94

1.Introduction

This section of the Operator's Handbook introduces you to the FORMAT controller, and also suggests how to use this handbook to best effect.

1.1. Introduction to FORMAT

The FORMAT 550 SERIES programmer/controller is a powerful chamber control system offering advanced features such as data logging and program editing.

The FORMAT 550 programmer represents the ultimate level of user friendliness in a dedicated test chamber controller/programmer. Such ease of use has been achieved by specialised software providing easily comprehensible data entry and information display.

All information and data are displayed on a 6 inch CRT screen. Data is entered to the computer via a keypad or through the communications interface. At all times the actual cabinet conditions are displayed in large figures at the top of the screen.

All of the command sequences are extremely simple to follow and hardly necessitate the in-depth learning of key sequences and alternatives.

Although the FORMAT will make programming the test cabinet a simple task it will not make the test sequences themselves any less complex. For this reason Program Sheets for many of the popular standard tests and blank sheets for your own programs have been produced. As a service, if requested when the cabinet was ordered, the FORMAT will be supplied with selected standard tests prestored.

As with any other high level system many error trapping and security systems are employed to ensure fool-proof operation.

1.2. Format digital channels

The FORMAT programming system fitted to the cabinet has up to eight digital channel functions. The digital channels are cabinet dependent. A number of the channels are for the control of the cabinet but require selecting on or off to achieve certain conditions. If applicable, other user designated channels are fitted, such as voltage free contacts for switching the test load. The selection of cabinet dependent digital channels is predicted by FORMAT and its suggestions will in most cases be adequate. The digital channels can however be operator selected to match particular requirements.The digital channels descriptive names are listed on applicable windows (screens) of the FORMAT display.

Full details of the function of the digital channels fitted are given in Part 1, Section 2.4 of this manual.

1.3. How to use these instructions

These instructions are written for the end user, and is not intended to be an engineering manual. For this reason it omits unnecessary detail concerning how the controller works, and concentrates on information the operator needs in order to make the best use of FORMAT's powerful capabilities.

Some users will find they are familiar with the system after only a short time. For such users, these instructions may be used as a reference guide; the sections are split into controller functions.

If you prefer a methodical approach to familiarising yourself with the FORMAT programmer/controller, it is recommended that you read all sections in order, trying out the topics described "hands on" as you go along.

As a minimum you should read sections 2 and 3 of the handbook, which describe the basics of using the controller.

2.Getting started

This section describes the basics of using the controller and the meaning of the various items of information presented on the screen.

2.1. The menu system

FORMAT uses a menu system to allow the operator to select what function the controller should perform. This approach will be familiar to users with experience of using personal computers.

When the chamber is first switched on, FORMAT goes through its startup sequence (which lasts approximately 1 minute) and then displays the initial Main Menu screen:

The Main Menu displays a list of options which are available to you, one of which is highlighted (Steady State in Figure 1). By using the "up" and "down" arrow keys, the "highlight bar" can be moved through the menu options.

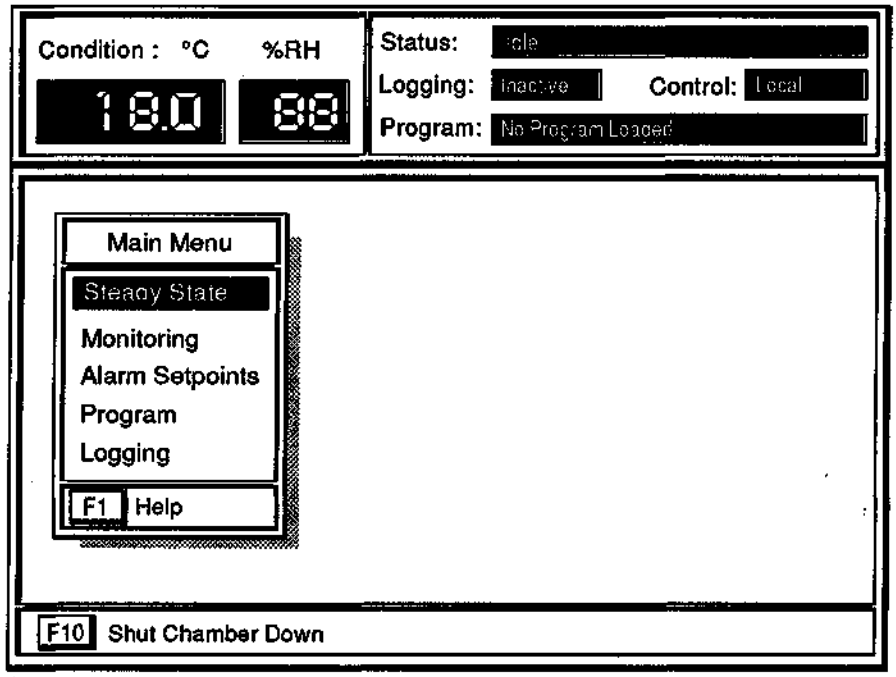


Fig 1 The Main Menu Screen

To select a menu option, move the highlight bar to the option you require, then press the "Enter" key.

Selecting some of the menu options (for example, Alarm Setpoints and Program) causes another sub-menu of options to appear. The highlight bar then appears on the sub-menu. To remove a sub-menu (returning the highlight bar to the parent menu), press the Esc key.

2.2. Using the on-line help

FORMAT has a context sensitive on-line help system activated by the F1 key. You can press the F1 key at any time while using the controller to obtain an information window summarising what actions are possible from the current position.

The on-line help system is not intended to be a replacement for this handbook, but provides a useful reminder for keystrokes and menu options.

If you find you are unsure of what to do next, your first action should be to call for the on-line help. In most cases this will give you sufficient information to let you carry on.

2.3. Function keys

Function keys are keys which cause the controller to immediately action a task. FORMAT has two kinds of function keys, namely "global" and "local":

2.3.1 Global function keys

These are keys which serve one fixed purpose and are operational all the time. An example is the F10 key which shuts the chamber down. This can be thought of as an emergency stop button. It is active all the time, whatever the controller is doing. Global function keys are shown at the bottom of the screen (see Figure 1).

2.3.2 Local function keys

These are keys whose function may change from one task to another. They are shown at the bottom of the window that the user is currently interacting with.

2.4. Using the data entry windows

When the controller needs information from you, it presents a data entry window. FORMAT has data entry windows for a multitude of different situations (e.g. asking you for a steady state condition or alarm setpoints), so they vary in appearance. Common to all of them, however, is a standard method of data entry and navigating the fields in the window.

2.4.1 Moving between fields

The "enter" or "right arrow" keys are used to move the input cursor to the next field of a data entry window. The key to move the input cursor to the previous field is the "left arrow". Keying past the last field causes a "wrap round" effect which moves the input cursor to the first field.

Information If however, you do wish to edit the digital channels, you should use the < and > keys. These keys do not skip the digital channel fields. When editing a program, if you use the "enter" key to move to the next field, the Digital Channel fields are skipped. This is because in most cases you would want to accept the suggested values prompted by the controller.

2.4.2 Types of data entry field

There are two types of data entry field. The most common is a "value" field. When the input cursor is on a value field, the operator should simply enter the appropriate value (e.g. temperature, digital channel state, file name, etc.). The other type of data entry field is a "selection list". When the cursor is on a selection list, you should use the "up" and "down" arrow keys to move the highlight bar to the appropriate selection.

2.5. The status bar

The status bar is the window of information displayed at the top of the screen. It is visible at all times. The data items displayed on the status bar are:

CONDITION: The temperature and relative humidity (if the controller is configured for humidity) inside the chamber is constantly displayed. The values displayed are updated every second. If the controller is configured for open loop control of a third channel (e.g. light level), this is not displayed (since the actual level is equal to the set point, which is displayed in the Monitor screen).

STATUS: This field describes what the controller is currently doing. It can take the value "idle" or "running".

LOGGING: This field describes the current status of logging. It may take one of the following values: "inactive", "sync", "alarm" or "active". "sync" indicates that logging will start when the chamber is run, and "alarm" indicates that logging will start when an alarm condition occurs.

PROGRAM: This field describes the state of the currently loaded program. If there is a program loaded, the name and description appears here. In addition, if it is running the word "active" appears to the right of the description. If editing has started on a new program, but that program has not yet been saved, the message "Not Named" appears in this field.

CONTROL: This field indicates the method by which FORMAT is being controlled. It may take the value "local" or "remote". Under normal circumstances this field will indicate "local", which means that the keyboard connected to FORMAT is controlling it. If the value is "remote", FORMAT is under the control of remote RS232 communications.

Note; FORMAT uses the following rules:

When running in steady state control mode:

- Temperature is in °C, humidity is in %RH.
- For digital channels 0 means OFF, 1 means ON.
- In manual mode control is continuous until stopped by the operator.

When running in program mode:

- Temperature is in °C, humidity is in %RH.
- A data segment is a point in time when a change in the data on which the programmer is acting upon is required.
- Times are specified as DAYS:HOURS:MINUTES:SECONDS.
- Each segment's time is from the start of the program.
- The first segment of a program has zero time.
- Each segment thereafter must be sequential with time.
- The maximum number of segments in each program is 150.
- For digital channels 0 means OFF, 1 means ON.
- Programs cannot be linked together.
- The mid-cycle start facility can operate at any time in the program's first cycle.

3. Steady state control

This section describes how to make the controller maintain a steady state condition.

GENERAL OPERATING SEQUENCE - STEADY STATE MODE

1. Select Steady State operation from the Main Menu
2. Enter the required temperature setpoint.
3. Enter the required humidity setpoint.
4. FORMAT will suggest the correct digital channel selection. Set the digital channels for non-chamber dependent digital channels (VFTs , etc) as required. Reset the suggested settings for the chamber dependent digital channels only if previous experience shows a need to.
5. Start steady state control and start the cabinet.
6. Run the cabinet under manual control for the desired length of time.
7. Stop manual control and switch off the cabinet.

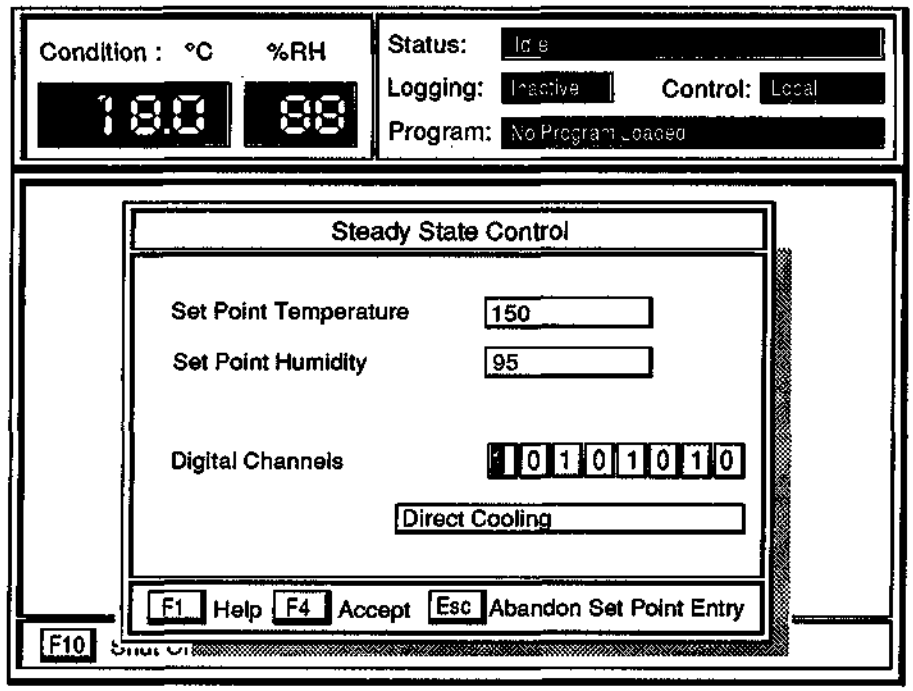


Fig 2. Steady State Data Entry Window

3.1. Condition setting

To set a condition on the controller, select the Steady State menu option. You will then be presented with the Steady State Data Entry Window:

Type in the required temperature in °C and press "enter". If you make a mistake while typing, use the "backspace" key to strike out erroneous digits.

Type in the humidity (in % RH) in the same way.

3.2. Resetting steady state setpoints

After you have entered a condition FORMAT will suggest digital channel settings. If you want to alter the suggested digital channel selections press "enter" (or "arrow right") key until the input cursor reaches the required field and press 1 or 0. Entering 1 switches a digital channel ON and 0 switches it OFF.

When you are satisfied with the data in the window, press the F4 function key to start the chamber running. The Status field at the top of the screen will change from "idle" to "running" to indicate that the chamber has started running.

If at any point while entering information in the data entry window you decide that you do not want to start the chamber, you can press Esc to cancel. This takes you back to the main menu.

3.3. Condition monitoring

When the chamber is running a steady state condition you can observe its settings by selecting the Monitoring option from the Main Menu. This brings up a Monitor Chamber window as shown in Fig 3. Note, the status bar shows the measured conditions.

In addition to the set point values for the steady state condition, the Monitor Chamber window displays the selected digital channels.

> Information When running a steady state condition, if you need to change to another condition it is not necessary to shut the chamber down first. You can go straight to the Steady State option on the Main Menu and enter the new condition and/or digital channels while the chamber is running. The changes will not take effect until you press the F4 function key.

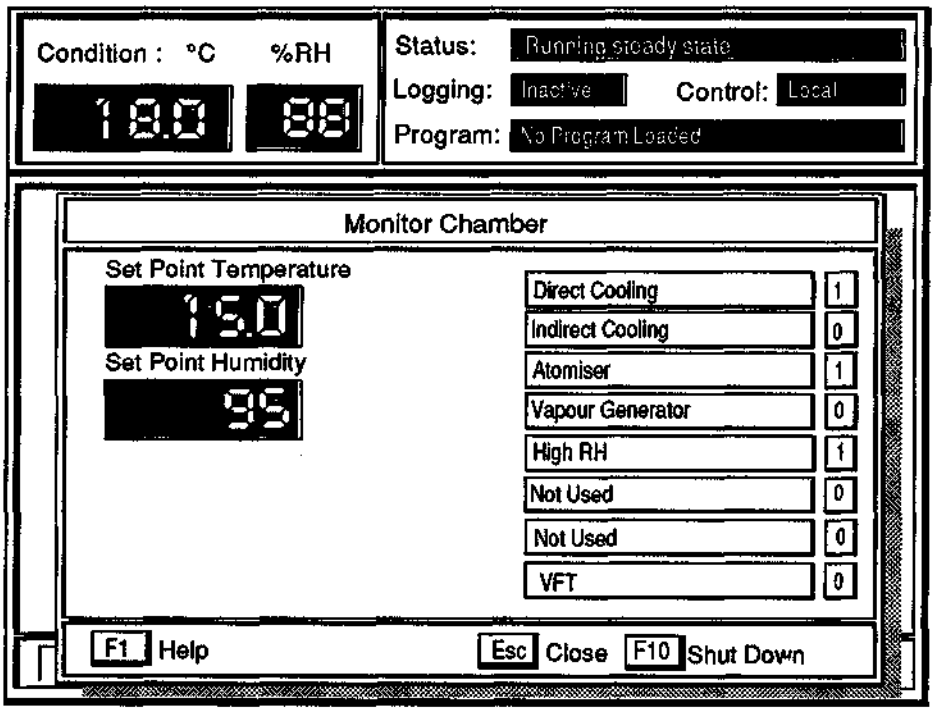


Figure 3 Monitoring a Steady State Condition

3.4. Ending manual control

To end steady state control press F10. A safety catch message will ask you "Are you sure you wish to shut down"

Note: this procedure terminates the FORMAT program, the cabinet should also be switched off by pressing the mains power pushbutton.

4.Programs

This section describes how to write, edit and run programs on the FORMAT 550.

GENERAL OPERATING SEQUENCE - ENTERING A NEW PROGRAM

1. Write out the program using the FORMAT program preparation sheets.
2. Select Program from the Main Menu.
3. Select New Program from the Program Menu.
4. Enter the program, segment by segment.
5. Save the program to disk.

GENERAL OPERATING SEQUENCE - RUNNING A PROGRAM

1. Select Program from the Main Menu.
2. Select the Load from Disk from the Program Menu.
3. Select the name of the program to be run.
4. Enter the number of cycles to be run, and if required, the mid-cycle start. time and delayed start time.
5. Start the program running, select Monitoring from the Main Menu to display the program running.
6. When the program has completed return the programmer to the main menu. If no further programs are to be run. then switch off the cabinet.

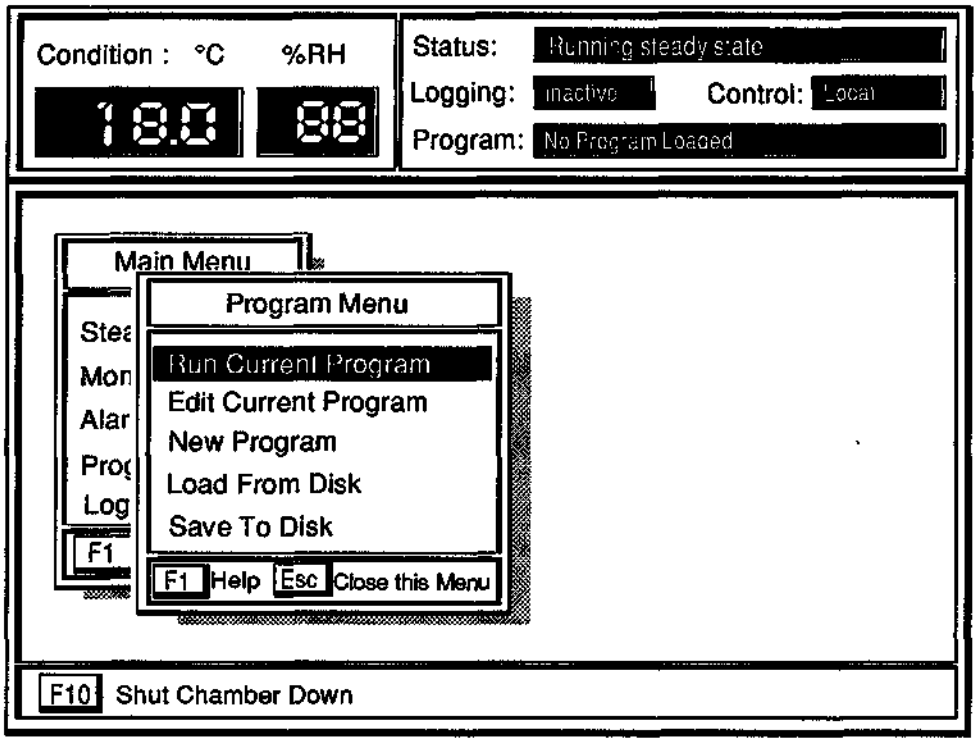


Fig 4. The Program Menu

4.1. Writing a Program

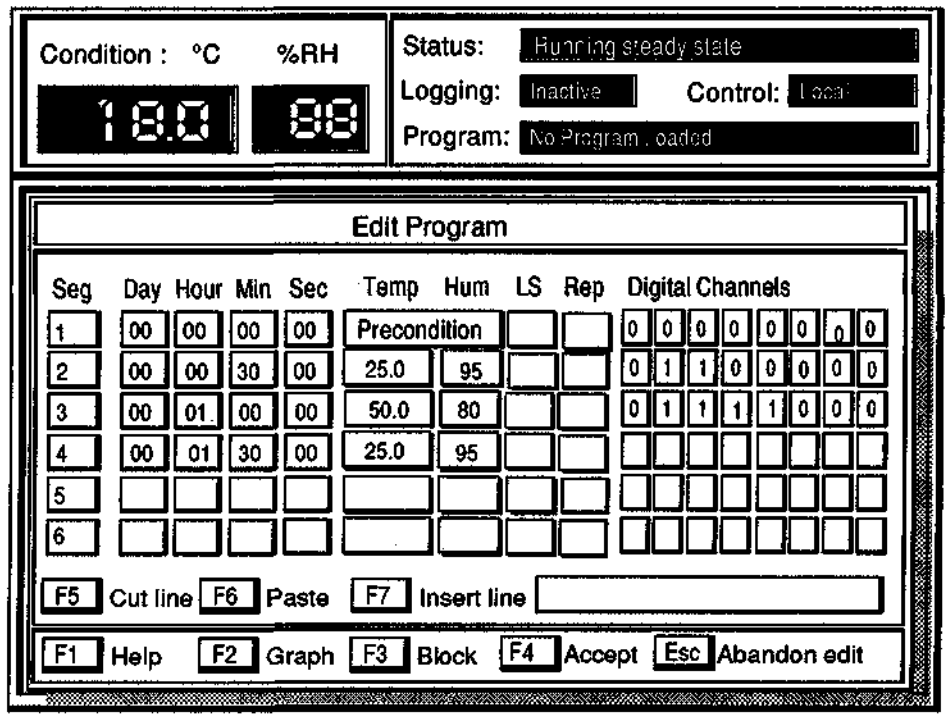


Fig 5. The Program Data Entry Window

When preparing a program for entry into the FORMAT programmer it is recommended that the provided programming sheets are used. Copies of programming sheets are available from Sanyo Gallenkamp (part number Z01442). A library of pre-prepared programming sheets and disks is also available covering many of the popular standard tests.

4.2. How to use FORMAT programming sheets

a. Draw out the graphic representation of the required test on the graph area of the programming sheet. This needs to indicate the "changes" (ramps) in temperature and humidity (if being programmed).

b. From the graph determine all data segments - the changes in the temperature and humidity data (often called corners).

A data segment is a point in time when a change in the data on which the programmer is acting upon is required. For example:

- a change in temperature, humidity from a ramp to a dwell.
- a change in programmed temperature ramp rate.
- switching on or off user digital channel(s).

A segment can reflect any number of changes providing they are required at the same time.

The first segment of any program starts at time 00:00:00:00 (days, hours, minutes, seconds). This corresponds to the instant the chamber starts running, at which time the condition inside the chamber is ambient.

The segment time is from the start of the program not from the previous segment.

The last segment's time must be the desired finish time of the program.

c. Enter onto the program sheet the corresponding changes that occur at each segment.

For future reference record on the sheet the program name used to store the program on floppy disk and the number of program cycles to be used when the program is run.

The following page shows a sample completed Programming Sheet.

4.3. Entering the data into the programmer

Select the New Program option from the Program Menu. This brings up the program editing window. Following the FORMAT programming sheet enter the time and conditions into each segment line

As you enter conditions, pressing "enter" between each field, you will notice that the digital channel fields are automatically populated by FORMAT. These are suggested digital channel values. If you wish to override the suggested values, move to the field you wish to change. You can then freely edit the digital channels.

You can perform "line cut and paste" editing on your program. In order to cut a line (i.e. remove from program but remember it for future pasting). Simply move the cursor to the line for cutting and press the F5 key. To paste the line again, move the cursor to the line where the cut information is to be pasted, and press F6. Future releases of the FORMAT software will also enable block cut and paste options.

To make space for a new line in a program, press F7.

When you have finished editing, press F4. This takes you back to the Program Menu. If you wish to keep the program, use the Save Program menu option, see section 4.4

Note: Programs written "on screen" are lost when the chamber is switched off or when there is a mains power interruption. Programs required for repeated use should always be saved.

4.3.1 Selecting digital channels when you know best

On some occasions the selection of digital channels suggested by Format550 is not the best for the particular circumstances you wish to control. Generally these cases involve loads which represent a significant thermodynamic load on the climatic systems. They could be active loads which dissipate heat within the chamber. Or they might be loads with significant mass which need to be taken through a rapid temperature change. Finding the best selection for digital channels in these circumstances may need trial and error, but as simple guidelines:

- wherever the thermodynamic load looks large, increase the cooling power, typically from aux to main or indirect to direct cooloing
- wherever the required temperature fall rate is high, increase the cooling power
- wherever high humidity is required with a load that tends to dehumidify, increase the humidifier power. Usually this involves selecting first the high RH channel. Then the vpg instead of the atomiser. In extreme cases it involves switching them both on together.
- loads that tend to dehumidify are those dissipating heat; remember that a large mass descending in temperature dissipates heat even though not powered

One area where Format550 cannot suggest selection is that concerning "user" digital channels (those other than system channels. No rules are pre-stored for them, other than that they are biased to "off". Program them on when you want them on. A typical example is channel 8 --- v.f.t.. Here you will need to program "1" to switch it on, and "0" to switch it off. These instructions can share a program line with a condition corner, or they can have a line of their own.

4.4. Loading and saving programs

When you save a program or load a program you must specify a "file name" to FORMAT. This must consist of 8 characters . As the Format 550 panel mounted keypad is numeric only, you are restricted to numeric identifiers.

When loading, you can select the program you want to load from a list rather than type the file name if you wish. Use the "up" and "down" arrow keys to select the file name of the program you want to load.

When saving, if you want to replace (i.e. update) a program that already exists , you can use the "up" and "down" arrow keys to select the file name of the program you want to replace.

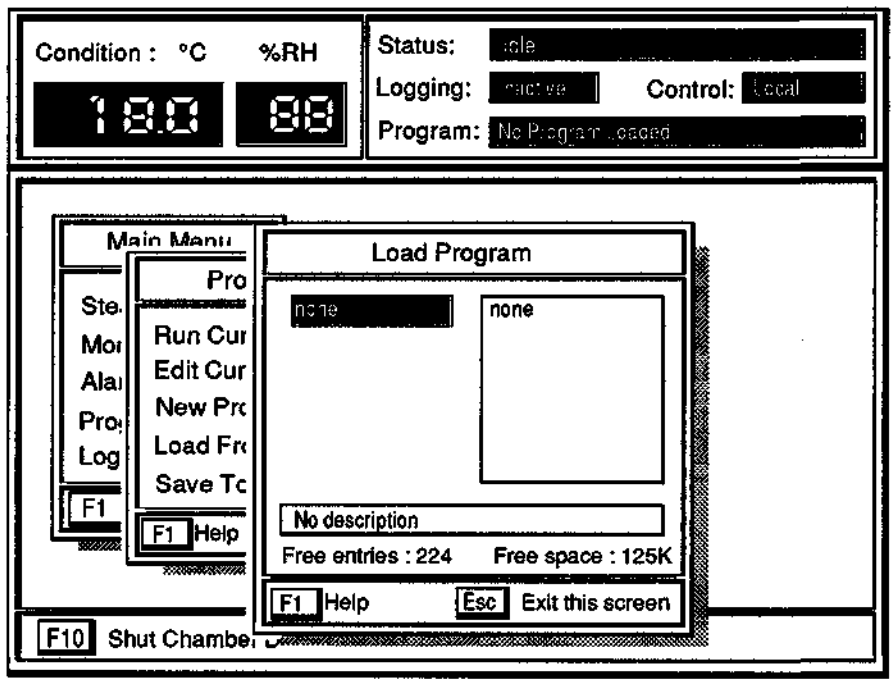


Fig 6. Load Program window

4.5. Running a program

When you choose Run Program from the Program Menu, provided the current program is valid, you will be presented with a data entry screen for run options. The options are:

NUMBER OF CYCLES: This is the number of times the program is repeated. This facility is of use for repetitive programs.

GUARANTEED SOAK: This option, when enabled, halts the program run time at each segment until the specified condition is reached.

TIME IN TO PROGRAM: This specifies at what time into the program you want the run to start.

Note: A mid-cycle start can only be initiated during the first cycle, ie at a time which is valid for the program.

COUNTDOWN TO RUN START: This specifies a delay before the chamber starts running. A delayed start to a program run can often be a very useful feature, for example starting a test at some point during the weekend so it finishes on monday morning.

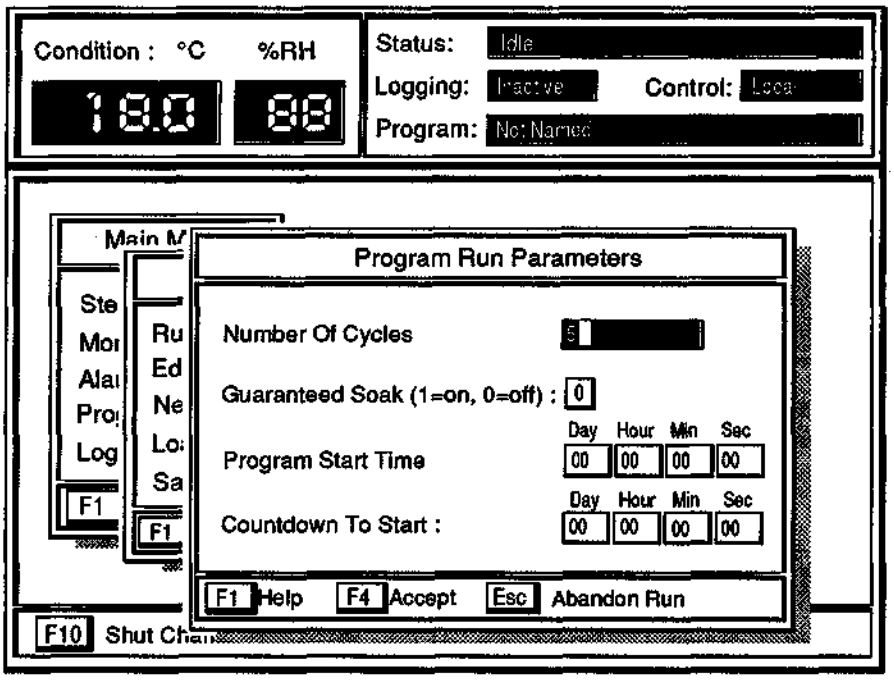


Fig 7. Run Program Parameters window

4.6. Program Monitor Window

When the run has started, you can observe the progress of the program by selecting the Monitoring option from the Main Menu.

In addition to the information displayed for a Steady State run, FORMAT displays the time into program run, number of program cycles left and the Time Hold mode.

The Time Hold mode can be Soak (if theGuaranteed Soak option was enabled at the Program Run window and the temperature and humidity are not within the preset limits), Eexternal (through a signal external to the controller, if fitted) or Manual. Manual Time Hold is effected by pressing the F2 key. The effect is to instantly freeze the program run time until it is pressed again.

You can stop a program run before it is completed by pressing the F10 key.

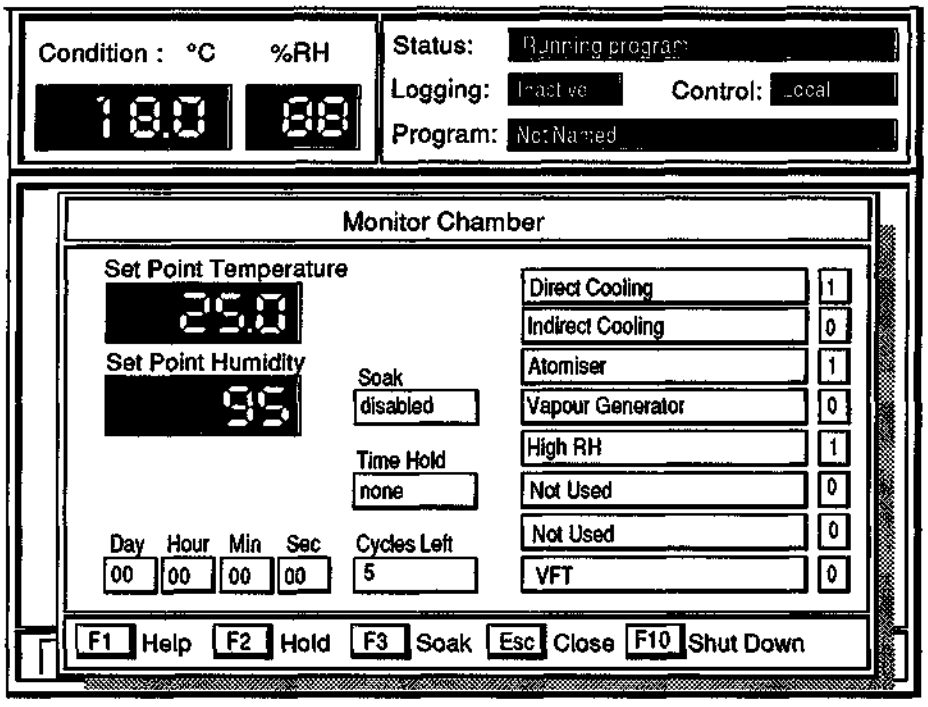


Fig 8. The Monitor Chamber window

4.7. Holding a program

To hold a program press F2 from the Monitor Chamber window.

The effect of holding the program will be immediately apparent as the time elapsed count (timebase) will stop. When a program run is held the temperature and humidity levels are controlled at the values of the calculated setpoints at the time the hold was initiated, digital channel output status is also held as determined at that point in the program.

To remove the hold press F2 again, and the program timebase will count again from where it was held.

4.8. Program completion

When a program has been completed the Main Menu is displayed showing the program status as idle.

4.9. Program deletion

Permanently deletes a single program.

Select Delete Program, select the program to be deleted and press <enter>.

4.10. View program graph

When a program is being editted or displayed on the Edit Program window after loading a visual representation of program may be displayed as a line graph by pressing F2

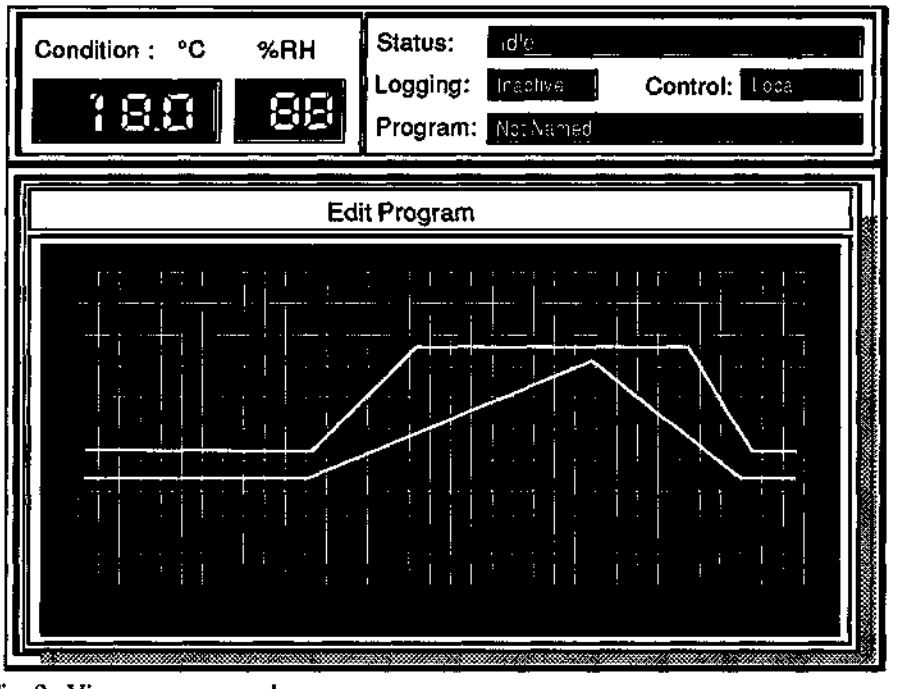


Fig 9. View program graph

5.Data Logging

This section describes how to start and stop logging, and how to import data into industry standard spreadsheet packages.

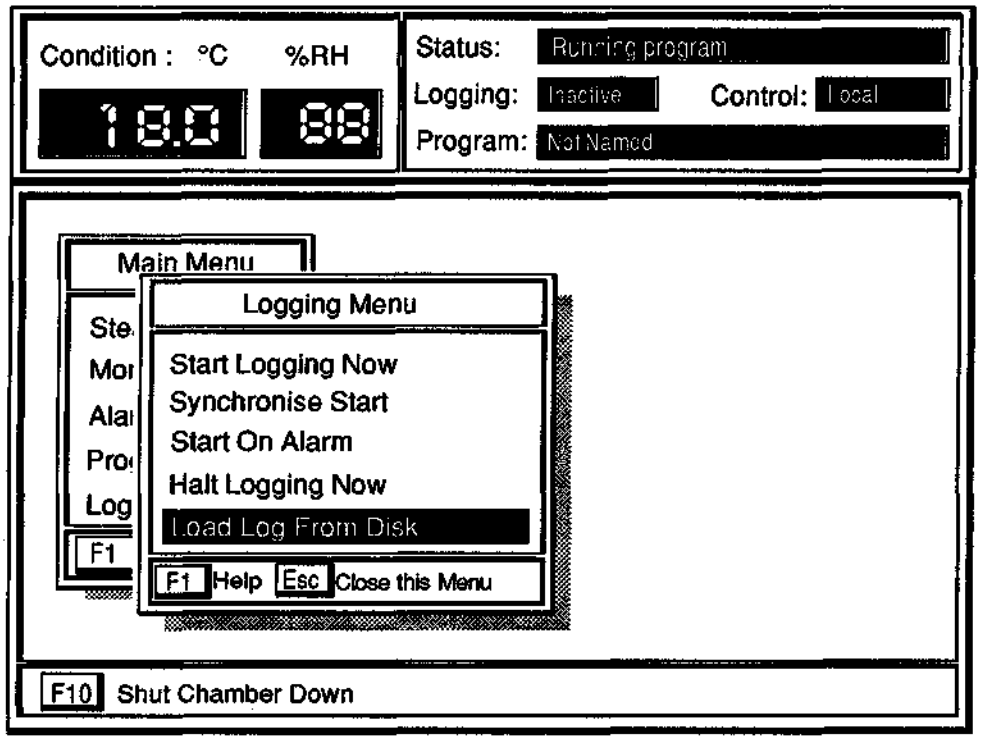


Fig 10. The Logging Menu

5.1. Introduction to Data Logging

Data Logging is selected from the Main Menu. There are three different ways data logging can be initiated: "Start Logging Now", "Synchronised Start" and " Start on Alarm". Whichever method you choose, you will be prompted for a file name for the data log.

5.2. Starting Data Logging

The simplest method to start data logging is to select the Start Logging Now menu option. This starts logging as soon as you have entered a file name.

You can also set logging to start at the same time that a program is run. Select Synchronise Start for this.

If you only want to start logging when an alarm condition occurs, select Start On Alarm.

The logging field in the status banner at the top of the screen changes to reflect the start mode you have chosen.

5.3. Stopping Data Logging

To stop FORMAT data logging, select the Halt Logging Now option from the Logging Menu.

5.4. Displaying Results

You can obtain a trend display of the data log from FORMAT using the Load Log From Disk option. This only displays the data in low detail.

5.5. Loading into Spreadsheets

Data Logs in FORMAT are stored as "comma separated fields". Most industry standard spreadsheet packages support this data format for importing into them. Although the method varies between spreadsheet packages, the basic technique is similar. The order of the second and third points in the list below may be interchanged:

Select the import option from your spreadsheet package. Specify the floppy disk drive and file name of the data log, and use the .LOG extension. Specify the type as "comma separated values".

6.Alarms

This section deals with setting alarms on the FORMAT controller.

6.1. Introduction to Alarms

FORMAT provides a comprehensive array of alarm triggers. Alarms are available on fixed high and low setpoints, or on deviation from control set point. The same alarm functionality is provided for both temperature and humidity channels.

Alarms can trigger several events:

Shuts the chamber down.

If you have set logging to start on alarm, data logging of the condition will start.

If your controller has been configured to use an alarm output, an external event may be triggered.

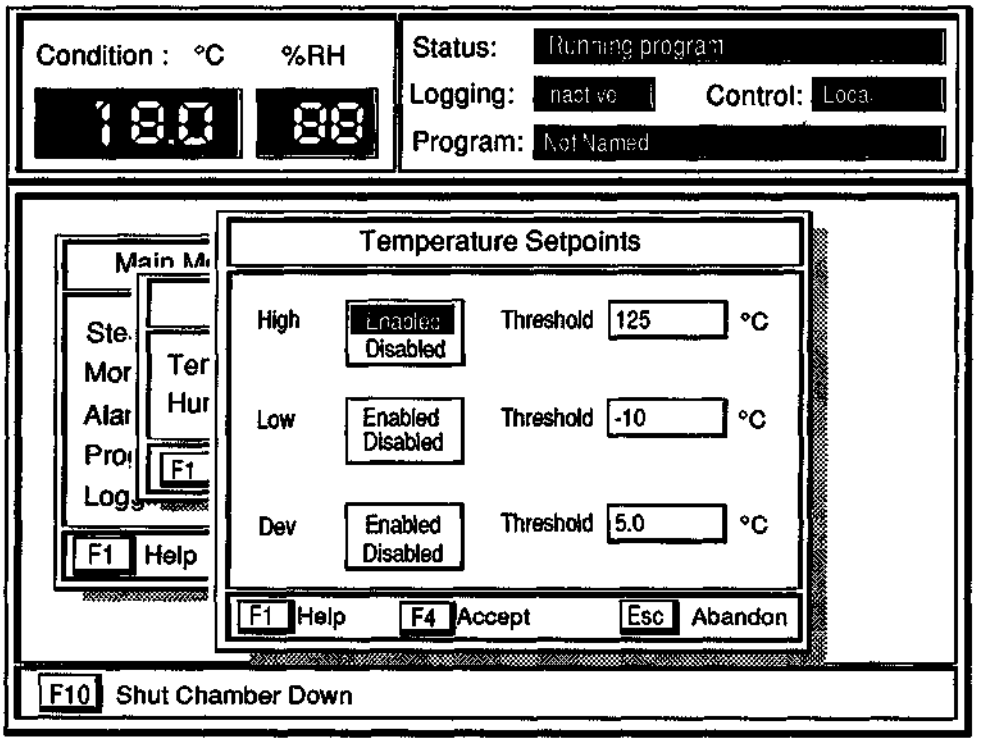


Fig 11. The Alarm Setpoints window

6.2. Setting Alarms

To set the alarm triggers, select the Alarm option on the Main Menu. This brings up a sub-menu from which you can select either Temperature or Humidity. After selecting either temperature or humidity, FORMAT presents a data entry window as shown below:

There are Alarm Setpoint data entry windows for both temperature and humidity alarms.

Set the alarm triggers by Enabling the relevant type of triggers, and then enter the threshold values for the triggers. You can have any combination of triggers enabled.

If an alarm is triggered then "Alarm" is shown in the Status window and if logging is selected then the alarm condition is logged to disk.

7.COMPUTER INTERFACING

7.1. INTRODUCTION

Using the RS232 port on the chamber the Format 550 can be interfaced to PC compatible computers.

Primarily there are at present two methods available to the user. However, this area of application continues to develop rapidly. If this manual does not fully address your application please contact SANYO Gallenkamp PLC or your dealer.

7.1.1 HOST SYSTEM

This is a software package that can be installed onto the hard disk of a personal computer. It enables the connection of up to 8 Format 550 controllers. Each can be addressed individually to allow uploading and downloading of programs.

It can be ordered from SANYO Gallenkamp PLC or your dealer (part number E03554). In fact this package can network a mixture of Format 500 & Format 550 controllers. The following notes deal with only a single connection to a single Format 550.

7.1.2 COMPUTER INTERACTIVE

In this situation software is written by the user to enable his chamber to be "slaved" to some other intelligent device. Typically this might be a system controller that is managing a test procedure being conducted on the test piece within the chamber. The system controller can make decisions and direct the operation of test device and/or chamber.

At a simple level this can take the form of the system controller requiring data about the chamber condition to add to a log already being acquired. A substantial protocol supports these interactions, & is described in section 8.2.

7.2. INSTALLING & USING A SINGLE CONNECTION HOST SYSTEM

HOST PC SYSTEM REQUIREMENTS

Hardware

- IBM PC compatible computer with 386SX processor (or better)
- VGA display adapter
- Hard disk with at least 2MB free
- 3.5" 1.44MB floppy disk drive
- RS232 serial port (COM1)
- Parallel Printer Port (LPT1)

Operating system

- MSDOS 5.0 or higher

Additionally recommended

- Mains Filter Unit

RS232 null modem cable: to connect Host PC to Format 550 RS232 port

Software Physical Components

- Installation disk
- Security key

7.2.1 INSTALLATION

Insert the Installation Disk in drive A of the Host PC, and at the DOS prompt, enter the following :

A: <enter>

INSTALL <enter>

The Host Software installation process will then begin. During installation, the Host Software is copied on to the Hard Disk, to a directory named \HOST.

INSTALLING THE SECURITY KEY

Before the Host Software can be used, the security key must be fitted. Insert the security key into the parallel printer port LPT1 of the Host PC. If you have a printer, connect this to the back of the security key. The security key is completely transparent to normal printer operation.

CONFIGURING THE HOST SOFTWARE

Before the Host Software can be used, the serial number of the Controller must first be written in a configuration file called HOST.CFG.

Use a standard text editor (such as EDIT supplied with DOS 5.0/6.0) to create and edit the HOST.CFG file in the C:\HOST directory on the Host PC. Enter the serial number of the Format Controller on a single line of the file. The serial number must be that of the CONTROLLER. This number must be entered literally, taking note of the case of the characters. Include SN. (eg, SN2-94001234)

SETTING UP OFF-LINE CHAMBER INTELLIGENCE

Before installing the Host Software, it is recommended that two files from the Controller System disk are first copied to the Host Directory. This enables the Host system to use their information without having to interrogate the controller each time.

The following files should be copied from the root directory of the Format 550 System Disk to the HOST directory of the Host PC

- LEARN.CFG
- DIG_CHAN.CFG

If you are unsure about this, please contact SANYO Gallenkamp PLC Service Dept.

Once installed on the PC, the Host Software has two modes of operation :

- On-line Mode (connected via RS232 port to Format 550 controller)
- Off-line mode (Host Software in stand-alone mode)

7.2.2 STARTING THE SOFTWARE

To run the Host Software, ensure that the security key is fitted and the enter the following at the DOS prompt :

CD \HOST <enter>

HOST <enter>

The Host Software will then start up in Network Monitoring Mode (see below).

7.2.3 NETWORK MONITORING MODE

When the Format 550 Host software is executed, it scans the network for a Format 550 controller which is switched on and connected to the Host and enters Network Monitoring Mode.

In this mode, the condition of up to 8 Format 550 Controllers may be seen on the screen of the Host PC. If there are no Controllers on the network (e.g. Host PC off-line), the condition panels are blank.

Underneath each condition display panel is the serial number. Underneath one of the condition panels is a flashing cursor. The arrow keys may be used to move this between panels.

With the cursor on the serial number of the connected Controller (any if off-line), press [ENTER] to enter the main menu for the selected controller.

Press [Esc] from the main menu to cause the Host software to return to Network Monitoring mode.

Press [Esc] from the Network Monitoring screen to exit the Host system and return to DOS.

7.2.4 MAIN MENU

Pressing Esc from the main menu causes the Host software to go back to network monitoring mode.

The MAIN MENU options are as follows:

- Steady state control
- Monitoring
- Program (downloading/uploading)
- Logging

STEADY STATE CONTROL

This option brings up a window which is identical to the Steady State Control window on the controller itself. The condition and digital channels can be entered exactly as on the controller. While this window is being displayed on the Host, the "Access" window on the controller contains the message "Remote", indicating that the Host temporarily has control, and that the chamber keypad is temporarily barred. Any attempt to select brings up a message "Access Denied - Host has Priority".

If Steady State Control is selected on the Host whilst the controller is in any of the following modes, a message will be displayed stating "Access Denied - Controller has Priority".

Press [Esc] to pass control back to the main menu.

- Steady State Control (entering setpoints)
- Run Program (entering program run options)

- Countdown to Run Start (delay before starting a program)
- Monitoring

The latter brings up a window which is identical to the monitoring window on the controller. If the controller stops running (i.e. the end of a program run or if Shut Down is pressed on the controller keypad), control passes back to the main menu.

PROGRAM

Selecting this menu option brings up a sub-menu :

- New Program - Clears program in Host memory and enters Edit mode.
- Edit Program - Allows program in Host memory to be edited.
- Load Program from Host Disk - Loads program from Host disk library to memory.
- Save Program to Host Disk - Saves program in memory to Host disk library.
- Delete Program from Host Disk - Deletes program from Host disk library.
- Load Program from Controller's Disk - Load program from Controller's local library to memory.
- Save Program to Controller's Disk - Save program in memory to Controller's local library.

LOGGING

Selecting this option brings up a menu with the following options :-

- Transfer Log from Controller - Copy data log from the controller to the Host disk. After selecting the data file to copy, the user is given the option to have the file deleted from the controller after copying.
- Load Log from Host Disk - Displays the data log traces on the Host PC. This is for verification of trends only :- no scales are displayed. A separate spreadsheet package may be used for detailed analysis and display of the logged data.

7.2.5 PRINTOUTS

You can print out hard copies of programs from your Host PC.

Call up the required program (program load from disk ESC edit program)

With the required program displayed in Edit mode, press [Print Screen]. A formatted listing will be produced (see sample).

In the sample, please note:

- that the Seg(ment) number has been incremented by 1 throughout.
- that there is an additional column "3rd". This ensures compatibility with Sanyo Gallenkamp's plant growth products, which control lighting via a third channel.

PROGRAM 2011db55 (No Description)

Seg	Time	Temp	Hum	3rd	LSeg	Rep	Digital Channels
	dd:hh:mm:ss	C	%RH	%			1 2 3 4 5 6 7 8
001	00:00:00:00	.....	...	...	0	0	0 1 1 0 1 0 0 0
002	00:00:00:01	25.0	97	...	0	0	0 1 1 0 1 0 0 0
003	00:02:50:00	53.3	97	...	0	0	0 1 1 0 1 0 0 0
004	00:03:00:00	55.0	95	...	0	0	0 1 1 0 1 0 0 0
005	00:03:10:00	55.0	93	...	0	0	0 1 1 0 1 0 0 0
006	00:11:50:00	55.0	93	...	0	0	0 1 1 0 1 0 0 0
007	00:12:00:00	55.0	96	...	0	0	0 1 1 0 1 0 0 0
008	00:12:10:00	53.3	99	...	0	0	0 1 1 0 1 0 0 0
009	00:13:30:00	40.0	99	...	0	0	0 1 1 0 1 0 0 0
010	00:16:30:00	25.0	99	...	0	0	0 1 1 0 1 0 0 0
011	00:16:31:00	25.0	98	...	0	0	0 1 1 0 1 0 0 0
012	01:00:00:00	25.0	98	...	0	0	0 1 1 0 1 0 0 0

Key for Digital Channels
1 = cooling 1 (main)
2 = cooling 2 (aux)
3 =
4 = vpg
5 =
6 =
7 =
8 = vft

7.3. Computer interactive interfacing: main protocol

This section defines fully the serial communications protocol implemented in the Format 550 Controller used on Sanyo Gallenkamp chambers and rooms. This protocol allows a master computer (System Master) to communicate with one or more Controllers on a network.

Typical applications include:

- where the chamber is required to operate interactively with the test procedure being applied to the test load within the chamber
- where a simple record of the conditions of the chamber is required directly into a logging system already being used.

The document describes in detail what a master computer should do to comply with the protocol.

This makes no assumption about the functionality of the master software. A particular Host Software package is available separately.

The protocol is defined in four layers:

Physical Layer defining electrical connections between controller & master

Frame Layer defining byte frame structure

Packet Layer defining information flow between controller & master

Information Layerdefining syntax of information passed

7.3.1 PHYSICAL LAYER DEFINITION

The medium used to connect Controller(s) to master depends on:

- the distance between master & Controller
- the number of Controllers

Master to single Controller:	Up to 50 feet	RS232
	Up to 1000 feet	RS485
Master to several Controllers:		RS485 bus.

The Chamber itself has a 25 pin RS232 port (connector 'D' type DTE) which is used for communicating with the master. A RS232 to 485 adapter is used when a RS485 hook up is required. The adapter uses the RS232's RTS line to control the data direction of the RS485 port.

7.3.2 COMMUNICATIONS FRAME DEFINITION

19,200 baud
1 start bit
8 data bits
0 parity bits
1 stop bit

7.3.3 PACKET LAYER DEFINITION

Data Packet Structure

Byte	Description	Byte Value range
1	Header	128 to 255
2	Packet Count	0 to 127
3	Serial No. Length S	1 to 127
4	Data block length D	1 to 127
5 to (4 + S)	Serial No.	32 to 127
(5 + S) to (4 + S + D)	Data Block	0 to 127
(5 + S + D)	XOR Checksum	0 to 127
(6 + S + D)	Additive Checksum	0 to 127

Minimum packet size is 8 bytes.
Maximum packet size is 260 bytes.

The same packet structure is used for both transmissions from the master (Command Packets) and transmissions from the Controller (Reply Packets). A dialogue is always initiated by a Command Packet from the master.

Header

This byte, which must have bit 7 set (i.e. value between 128 and 255), identifies the purpose of the packet (a full description of all the different types of packet is given later).

Packet Count

This byte may take a value between 0 and 127, and should be incremented by 1 for each Command Packet transmitted by the master, except when the packet is a retransmission due to the fact that no reply was received to the last Command Packet (in which case the Packet Count should remain at the value of the original Command Packet).

When the Packet Count reaches 127, the Packet Count of the next Command Packet should be 0. When the Controller replies, the Packet Count byte in the Reply Packet is set to the same value as in the corresponding Command Packet. This allows the master to positively associate Reply Packets with Command Packets.

The Controller does perform validation of the Packet Count field in some circumstances. For example, when transferring a file from the master to a Controller, the file is split into packets and transmitted one packet at a time. As the Controller receives each packet it acknowledges this to the master. It is possible, however, that the acknowledgement is lost (e.g. due to noise), and the master has no way of knowing whether the Controller ever received that packet or not (as far as the Controller is concerned, the transaction was completed successfully). In this case, after the time-out period has elapsed (see below; Packet Timing) when the master re-transmits the Command Packet, the Packet Count will be the same as in the preceding Command Packet. The Controller, upon receiving this duplicate packet (which it can identify by the Packet Count) simply acknowledges the packet, but does not store the data.

Serial Number Length

In Command Packets this is set to the length (in characters) of the serial number of the Controller to which the packet is intended. In Reply Packets, this is set to the length (in characters) of the serial number of the Controller which is transmitting the reply.

Data Block Length

This is set to the number of data bytes which follow in this packet. The minimum value is 1, so if there are no data bytes, this should be set to 1 and the data block should contain a single null byte (value 0).

Serial Number

In Command Packets this field contains the serial number of the Controller to which the packet is intended, encoded in ASCII. In Reply Packets, this field contains the serial number of the Controller transmitting the Reply Packet.

NB: this refers to the serial number of the CONTROLLER, not the chamber.

Data Block

This field is used mainly in Reply Packets from the Controller to pass back the information requested in Command Packets from the master, although some Command Packets also have data associated with them. In general, the data bytes contained in the Data Block are printable characters encoded in 7 bit ASCII (values 32 to 127). The bytes may contain any 7 bit value (0 to 127).

XOR Checksum

This is an "exclusive OR" checksum calculated from all bytes from the Header to the last byte in the Data Block (inclusive). The checksum is calculated as follows. A byte variable C is initialised to 128. As each byte in the packet is transmitted, each bit in C is XORed with the corresponding bit in the byte being transmitted. After all bytes have been transmitted (up to and including the last data byte), C contains the result of the checksum calculation and is transmitted.

Additive Checksum

This is a sum of all bytes transmitted in the packet up to and including the last data byte, modulo 128 (i.e. the remainder, after dividing by 128 the sum of all bytes transmitted).

Compatibility with RS485 Multi-Controller Configuration

The RTS signal on the RS232 port controls data direction on the RS485 bus. Normally, the RTS line should be left unasserted by the master. Just before the master transmits a packet, it should assert the RTS line (to drive the master's RS485 port to Output mode). After the master has completed transmission of a packet, the RTS line should be dropped within 0.05s (but not before the stop bit of the last byte has been transmitted).

The Controllers normally have their RTS lines unasserted, so that their RS485 ports are in Input mode waiting for transmissions from the master.

When a Controller is about to transmit a reply packet, its RTS line is asserted (driving its RS485 port to Output mode). After the Controller has completed transmission of a packet, the RTS line is dropped within 0.05s. This means that the master must wait at least 0.05s before raising RTS to transmit the next Command Packet.

Packet Timing

In most instances, the Controller will issue a Reply Packet in response to a Command Packet from the master within 1 second.

The Controller has buffered interrupt driven communications. This ensures that Command Packets from the master cannot be lost even if the Controller's processor is preoccupied with another task. If the Controller's processor is preoccupied, however (e.g. accessing the disk or repainting an area of the screen), the Controller will not issue the Reply Packet immediately.

The master should allow the Controller up to 12 seconds to reply. If no reply is received 12 seconds after the Command Packet was issued, it can be assumed that communications have been lost with that Controller (e.g. noise caused Command Packet to become corrupted, Controller switched off or disconnected, etc).

Important

It is important that the master should wait for a reply from the Controller (up to the 12 second time-out) before issuing any more Command Packets. If this precaution is not observed, a packet clash could take place on the RS485 bus. Even if the master software is only intended to run in a single Controller configuration (using RS232), observing this precaution will ensure compatibility with the RS485 configuration.

Packet Flow Summary

- master transmits Command Packet to Controller.
- if the Controller fails to receive the packet in full, or one of the check-sums is wrong, the packet is ignored & the Controller takes no further action. In this case, the master would realise that the packet was lost after the time-out period, & would be able to re-transmit the Command Packet.
- if the Controller receives a correct Command Packet from the master, it acts on the command and issues the appropriate Reply Packet as soon as it can (usually within 1s, but always within 12s).

7.3.4 FUNCTIONAL LAYER DEFINITION

Types of Packets

Description	CONTROLLER CONFIGURATION REQUEST
Type	Command
Source	master
Header	128
Data Block	No

This packet instructs the Controller to reply with information as to its type and configuration.

Description	CONTROLLER CONFIGURATION
Type	Reply
Source	Controller
Header	128
Data Block	22 bytes

The data bytes of the Controller Configuration Reply are as follows (in the order in which they appear in the data block):

4 bytes: Controller type string, (2000 for Format 550)
4 bytes: Controller software version string (100ths with leading zeros),
eg "0144" represents V1.44.
1 bytes: humidity enabled. (1=enabled, 0=temperature only chamber)
1 byte: third variable enabled. (1=enabled; 0=no third variable);
normally "0" for Genus chambers.
12 bytes: Third Variable description string; eg "Light".
This string contains trailing spaces to pad to 12 characters.

Description	STATUS REQUEST
Type	Command
Source	master
Header	129
Data Block	No

This packet instructs the Controller to reply with information as to the status of the Controller

Description	STATUS REQUEST
Type	Reply
Source	Controller
Header	129
Data Block	123 bytes

The data bytes of the Status Request Reply are as follows (in the order in which they appear in the data blocks).

1 byte: Running status:

0 = idle
1 = running steady state
2 = N/A
3 = running a program
4 = counting down to program start

starts byte No 001
ends byte No 001

1 byte: Controller Data Entry Activity. Value when the Controller is displaying any of the following data entry screens:

Steady State
"1", 2 SP (Format 500 only)
"2", Program Run (Format 550 only)
"3", Countdown to Program Start (Format 550 only)
"4", Program Edit (Format 550 only)
"5", Engineering (Format 550 only)
"6". Byte set to "0" for all other screens. When this byte is not set to "0", the Set/Change Steady State Condition Command Packet (see below) is not operational (Controller has priority over master).

starts byte No 002
ends byte No 002

1 byte: Logging Status

0 = inactive
1 = active

starts byte No 003
ends byte No 003

1 byte: Temperature Alarm Status

0 = in limit
1 = in alarm

starts byte No 004
ends byte No 004

1 byte: Humidity Alarm Status

0 = in limit
1 = in alarm

starts byte No 005
ends byte No 005

6 bytes: Temperature in degC, eg "-150.0"

starts byte No 006
ends byte No 011

3 bytes: Relative Humidity in %, eg "095"	starts byte No 012 ends byte No 014
6 bytes: Temperature Setpoint in degC, eg "-150.0"	starts byte No 015 ends byte No 020
3 bytes: Relative Humidity Setpoint in %, eg "095"	starts byte No 021 ends byte No 023
3 bytes: Third Variable setpoint in %, eg "050"	starts byte No 024 ends byte No 026
3 bytes: Intelligence Table Line, eg "001"	starts byte No 027 ends byte No 029
7 bytes: Temperature P term, eg "-123.45	starts byte No 030 ends byte No 036
7 bytes: Temperature I term, eg "-123.45"	starts byte No 037 ends byte No 043
7 bytes: Temperature D term, eg "-123.45"	starts byte No 044 ends byte No 050
3 bytes: Heating Effort in %, eg "100"	starts byte No 051 ends byte No 053
3 bytes: Cooling Effort in %, eg "100"	starts byte No 054 ends byte No 056
7 bytes: Relative Humidity P term, eg "-123.45"	starts byte No 057 ends byte No 063
7 bytes: Relative Humidity I term, eg "-123.45"	starts byte No 064 ends byte No 070
7 bytes: Relative Humidity D term, eg "-123.45	starts byte No 071 ends byte No 077
3 bytes: Humidification Effort in %, eg "100"	starts byte No 078 ends byte No 080
3 bytes: Dehumidification Effort in %, eg "100"	starts byte No 081 ends byte No 083
8 bytes: Running Digital Channels, eg "10110010"	starts byte No 084 ends byte No 091
6 bytes: Temperature Setpoint No 1 in degC, eg "-150.0" (f500 only)	starts byte No 092 ends byte No 097
3 bytes: Relative Humidity Setpoint No 1 in %, eg "050" (f500 only)	starts byte No 098 ends byte No 100
6 bytes: Temperature Setpoint No 2 in degC, eg "-150.0" (f500 only)	starts byte No 101 ends byte No 106

3 bytes: Relativ Humidity Setpoint No 2 in %, eg "050" (f500 only) starts byte No 107
ends byte No 109

8 bytes: Time:
time int running program
in "hhm ss" starts byte No 110
ends byte No 117

4 bytes: Cycle N nber:
Cycles r maining in running program eg "0001" starts byte No 118
ends byte No 121

1 byte: Hold Sta (during program run only)
0 = time se not held
1 = man l hold
2 = exte ally held
3 = soak eld (to guarantee the soak period) starts byte No 122
ends byte No 122

1 byte: Guarante Soak enable Status (during program run only)
0 = disal d
1 = enab d starts byte No 123
ends byte No 123

Description	SHUT CHAMBER DOWN
Type	Command
Source	master
Header	130
Data Block	No

This pac instructs the Controller to shut the chamber down.

Description	SH UT CHAMBER DOWN
Type	R dy
Source	Controller
Header	130
Data Block	No

This pack from the Controller confirms that the chamber was shut down.

Description	OPEN FILE FOR READING
Type	Command
Source	master
Header	131
Data Block	13 bytes

This pack instructs the Controller to prepare a file for reading by the master.
The data tes are as follows:
1 te: Drive to search
0 = system drive
1 = data drive
12 ytes: File Name String (left justified),
eg "LOGIC.cfg "
(no leading spaces; no included spaces)
(pad to 12 characters with trailing spaces)

Only ONE file may be opened at a time.

The master should take some special precautions before issuing this command.

Firstly, to ensure that no file activity takes place on the Controller during the file transfer, the master should send a Set Controller to Remote Access Mode command packet (see below). This locks out the keyboard on the Controller.

- Next, the master should use a Status Request command to ascertain the data entry mode of the Controller.

- If the Controller is in Engineering, opening a .CFG file should not be allowed.

- If the Controller is in Program Edit, opening a .PRG file should not be allowed.

- If logging is active, opening a .LOG file should not be allowed.

Only after checking these criteria should the master proceed to Open the file on the Controller for reading. After the file is read and closed, the master should then issue a Set Controller to Local Access Mode command packet to restore the Controller's local keyboard operation.

Description	OPEN FILE FOR READING
Type	Reply
Source	Controller
Header	131
Data Block	1 byte

"0" if there was an error opening the file (e.g. file in use, does not exist, etc),
"1" if the file was opened successfully.

Description	CLOSE FILE
Type	Command
Source	master
Header	132
Data Block	No

Closes a file opened for reading or writing.

Description	CLOSE FILE
Type	Reply
Source	Controller
Header	132
Data Block	No

The Controller sends this packet to the master to confirm that the file was closed.

Description	READ DATA
Type	Command
Source	master
Header	133
Data Block	No

Instructs the Controller to read the next block of data from the file and send to the master.

Description	READ DATA
Type	Reply
Source	Controller
Header	133
Data Block	Even number up to 126 bytes

Data block contains up to 63 hextuples representing the next block of data from the file. For example, the sequence of bytes 4Ah, 80h, 25h, 30h would appear in the data block as the string "4A802530". If the Controller has no more bytes to send, a data block of one null byte is transmitted by the Controller.

Description	OPEN FILE FOR WRITING
Type	Command
Source	master
Header	134
Data Block	13 bytes

This packet instructs the Controller to prepare to write a file to the Controller's disk. This will overwrite any file of the same name on the disk (the master can use the Open for Reading command to check if a file of the same name is present first, and then closing the file straight away).

The data bytes are as follows:

1 byte:Drive, "0"=system drive, "1"=data drive

12 bytes: File name string (left justified), eg "LOGIC.CFG "

Exactly the same precautions as with Open File for Reading apply to this command.

Description	OPEN FILE FOR WRITING
Type	Reply
Source	Controller
Header	134
Data Block	1 byte

"1" if file was opened successfully, or
"0" if the Controller failed to open the file for writing (file in use, disk write protected, etc).

Description	WRITE BLOCK TO FILE
Type	Command
Source	master
Header	135
Data Block	Even number up to 126 bytes

Send a block of data to the Controller for writing to a file opened with Open File for Writing. Data block contains up to 63 hextuples representing the next block of data to write to the file. For example, the sequence of bytes 4Ah, 80h, 25h, 30h would appear in the data block as the string "4A802530".

Description	WRITE BLOCK TO FILE
Type	Reply
Source	Controller
Header	135
Data Block	No

The Controller sends this packet to the master to confirm that the block of data has been written.

Description	SET CONTROLLER TO REMOTE ACCESS MODE
Type	Command
Source	master
Header	136
Data Block	No

This instructs the Controller to ignore key presses on its local keyboard and display "Remote" in the Access window.

Description	SET CONTROLLER TO REMOTE ACCESS MODE
Type	Reply
Source	Controller
Header	136
Data Block	No

This packet is sent by the Controller to confirm to the master that the Controller is switched to Remote Access Mode.

Description	SET CONTROLLER TO LOCAL ACCESS MODE
Type	Command
Source	master
Header	137
Data Block	No

This instructs the Controller to allow key presses on its local keyboard and dis play "Local" in the Access window.

Description	SET CONTROLLER TO LOCAL ACCESS MODE
Type	Reply
Source	Controller
Header	137
Data Block	No

This packet is sent by the Controller to confirm to the master that the Controller is switched to Local Access Mode.

Description	SET/CHANGE STEADY STATE CONDITION
Type	Command
Source	master
Header	138
Data Block	20 bytes

This command instructs the Controller to run a steady state set point. The data block parameters are as follows:
- 6 bytes: Temperature Set Point in °C, eg "-150.0". There should be no spaces in this string; zeros should be used to pad the string, e.g. -10°C should be represented as "-010.0". 4.3°C should be represented as "0004.3".
- 3 bytes: Relative Humidity Set Point in %, eg "100". There should be no spaces in this string; e.g. 0%RH should be represented as "000".
- 8 bytes: Digital Channels, eg "10010011".

Description	SET/CHANGE STEADY STATE CONDITION
Type	Reply
Source	Controller
Header	138
Data Block	1 byte

Data byte set to "1" if set point changed successfully, or "0" if access is denied (controller has priority).

Description	DIGITAL CHANNEL DESCRIPTION
Type	Command
Source	master
Header	139
Data Block	1 byte

This instructs the Controller to reply with the description of a digital channel. The data byte is a numeric string, from "1" to "8", representing the digital channel in question.

Description	DIGITAL CHANNEL DESCRIPTION
Type	Reply
Source	Controller
Header	139
Data Block	30 bytes

The data block of this packet contains the digital channel description.

Description	ENABLE/DISABLE GUARANTEED SOAK
Type	Command
Source	master
Header	140
Data Bloc	1 byte

This instructs the Controller to enable or disable the Guaranteed Soak option while running. Data byte set to "1" to enable, "0" to disable.

Description	ENABLE/DISABLE GUARANTEED SOAK
Type	Reply
Source	Controller
Header	140
Data Block	1 byte

Data block contains "1" if successful, "0" if not (eg, chamber not running)

Description	ENABLE/DISABLE MANUAL HOLD
Type	Command
Source	master
Header	141
Data Block	1 byte

This instructs the Controller to enable or disable the manual timebase hold. Data byte set to "1" to enable, "0" to disable.

Description	ENABLE/DISABLE MANUAL HOLD
Type	Reply
Source	Controller
Header	141
Data Block	1 byte

Data block contains "1" if successful, "0" if not (eg, chamber not running)

Description	GET SUGGESTED DCS
Type	Command
Source	master
Header	142
Data Block	9 bytes

Obtains the recommended digital channel selections for a given temperature/RH setpoint pair. Data block is arranged as follows. (The same rules about spaces & zeroes apply to these fields as with command 138.

- 6 bytes: temperature in °C, eg 2-150.0"
- 3 bytes: Relative Humidity in %, eg "100".

Description	GET SUGGESTED DCs
Type	Reply
Source	Controller
Header	142
Data Block	8 bytes

8 data bytes contain the recommended digital channel selections for a given temperature/RH setpoint pair, eg "01001100". If there is not an entry in the Controller's intelligence table the string "NNNNNNNN" is returned. (The same rules about spaces & zeroes apply to these fields as with command 138)

7.4. Cable connections

Format 550 communications require a cable of the following connections to be fitted between the cabinet and the communicating PC.

Computer RS232	**Computer RS232**	**Format 550 socket**	
9 pin D type	**25 pin D type**	**25 pin D type**	
9	22	8	(CDR)
3	2	3	(RXR)
2	3	2	(TXR)
6	6	20	(DTR)
5	1 & 7	7	(GRD)
4	20	6	(DSR)
8 link to 7	5 link to 4	4	(RTS)
7 link to 8	4 link to 5	5	(CTS)
1	8	22	(RI)

7.5. Support software

Because this is a rapidly developing aspect of the applications of Format 550, SANYO Gallenkamp PLC continue to expand the range of support available for these systems. If your application is not covered here, please contact our Service dept or your dealer.

Applications currently being explored include simple routines to interrogate the chamber in terms of temperature & humidity, potentially to be available in B.A.S.I.C. source code and as compiled .EXE files.

APPENDIX 1 - TECHNICAL SPECIFICATION

Temperature & Humidity Programmer/Controller with inbuilt Logic, chamber intelligence mapping, & Data Logging

Operator interface data entry: on-chamber dedicated numeric keypad.

display: on-chamber (green) monochrome CRT.

Operating temperature: 5°C to 60°C.

Analogue inputs Two 4 wire PRT inputs. Range -150°C to +350°C. Accuracy +/- 0.1°C. Dedicated to measuring temperature and humidity (relative humidity is derived by wet & dry bulb by psychrometric computation).

Calibration of the analogue inputs: performed in software; there are no presets to adjust.

Control Loops

Temperature. Three term (P.I.D.) digital control, using trapezoidal approximation to interpolate between samples. Input sample and control period is 4 seconds. Output of control algorithm is heat digital mark space ratio (with -100% to +100% dead band adjustment). Set point resolution 0.1oC.

Relative Humidity. Three term (P.I.D.) digital control, using trapezoidal approximation to interpolate between samples. Input sample and control period is 4 seconds. Output of control algorithm is humidify digital mark space ratio (with -100% to +100% dead band adjustment). Set point resolution 1 %RH.

Controller Intelligence For all regions of the chamber performance envelope, a table pre-stores:

a map of appropriate "housekeeping" facilities

a map of appropriate P.I.D. controller coefficients.

Maps are not displayed on the controller. Housekeeping: Digital channel selection: by autosuggestion from intelligence at setpoint entry. Over-ride: available at keypad.

Internal Defrost Clock: Invoked automatically if required (from intelligence).

Steady State Control The controller allows set point values to be entered for temperature and humidity. With autosuggested or manually input digital channel selections.

Programs

Library capacity: 20 programs nominal (leaves space for 1 week log) program size: 150 lines/segments max per program, 10 kbytes approx per program. segment/line content: time + any of: temperature, humidity, digital channel, loop

time basis: time from program start

time units: days, hours, minutes, seconds

editing facilities: line cut; paste; block copy

loop: facility to repeat program sections

nesting: (loops within loops) supported

file facilities: save, load, delete

precondition: line 000 omits after 1st cycle.

Program Run Options

Repeats: up to 9999 cycles

Guaranteed Soak: active:at start of each program segment

arming: preset at run start, or manually during program run

criteria: temperature error 0.5oC, or relative humidity error 1%

action: program time base is arrested until the condition returns inside limits.

Run start facilities: in-cycle start (specify time into first cycle)

delayed start (allows unsupervised start).

Monitoring displays

Steady state: setpoints, digital channel status

running program: setpoints, digital channel status, soak status, hold status,

time into program run, number of cycles remaining

Facilities: turn on/off timebase hold, turn on/off guaranteed soak.

Alarms. parameters: temperature, humidity

type: high, low, deviation

range: chamber range

Data Logging Log content:actual temperature, actual humidity, time

setpoint temperature (synch start), setpoint humidity (synch start)

Log interval:one minute

Log information source: control probes

Log entry size: 100 bytes

Log triggers: manual, synchronised, alarm

Log preview: simple trend graphic

File facilities: load, delete

Log format: comma separated values (import to industry standard spreadsheets).

Storage media: internal floppy diskettes (2), one system and one program/log data disk

Digital outputs: 50 way connector interfaces inside chamber to SSR drives.

Digital input: dedicated to the External Hold facility (internal access only, contact SANYO Gallenkamp PLC or your dealer for applications)

Data communications: port on chamber: RS232, 25 pin "D"

support software: available separately

hard copy: program printouts are available using the above software

APPENDIX 2 - PROGRAM LOOPING AND NESTED LOOPS

You can program loops in format550. In addition you can program loops within loops (nesting). This section tells you how, with simple examples.

LOOP INSTRUCTIONS

The loop instructions are achieved using the "LS" & "Rep" columns that appear on the program preparation sheet & on the program window of the system.

In the line from which you want to loop back:

- in column "LS" you specify which line you want the program to loop back to.
- in column "Rep" you specify how many times you want the program to repeat this part of the program.

The program loops back from the time line in which the loop is listed, to the first line in the loop.

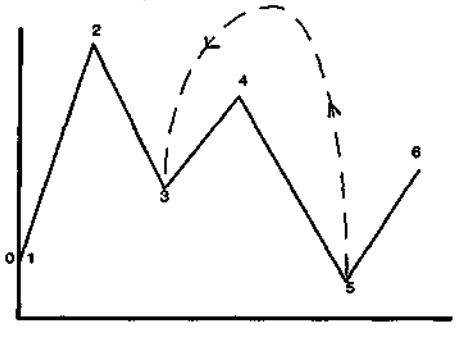
EXAMPLE 1

Taking a simple example: You require the temperature to cycle from 25°C to 85°C, then to 35°C, then to 65°C, then to 15°C, before returning to 25°C. But you want to cycle through the 35/65/15 part three times in all before emerging at the final 25°C.

To do this you would program:

Seg	Time	Temp	Hum	LS	Rep	Digital Channels
	dd:hh:mm:ss	°C				
000	00:00:00:00					
001	00:00:00:01	25.0	65			
002	00:00:00:20	85.0				
003	00:00:00:40	35.0				
004	00:00:01:00	65.0				
005	00:00:01:20	15.0		3	2	(2 reps + original)
006	00:00:01:40	25.0	65			

(the times are unrealistic for environmental test purposes, but they provide a program that can be cycled quickly to see the effects.)



When you run this program you will see that it causes the temperature to return to 25°C (point 6 in the diagram) at 3 minutes after the start of the cycle, not at 1 minute 40 seconds as listed. This is because the looping interferes with Format 550's timekeeping.

Due to the disruption of the internal timekeeping, the listing of events that succeed loops is no longer derived directly from the start of the cycle. A simple calculation is required to determine when to program the statement for each succeeding event.

CALCULATION FOR SUCCEEDING EVENTS

Call the target time for the succeeding event, the "event statement time". Call the time when the event is required the "event actual time". (Both times are from the start of the cycle.)

event statement time = event actual time - total looping time

The "total looping time" is the time to execute the loops as defined by LS & Rep.

If in the above example it is required to end the cycle at 3:40:

event statement time = 3:40 - 1:20 = 2:20

EXAMPLE 2

in the following example the temperature is required to reach 95°C at 4 minutes 55 seconds into the cycle:--

event statement time = 4:55 - 1:45 = 3.30

- 4:55 event actual time (when you want it to occur)
- 1:45 total looping time (Rep multiplied by the time from the start of the loop to its end)

To do this you would program:

Seg	Time	Temp	Hum	LS	Rep	Digital Channels
	dd:hh:mm:ss	°C				
000	00:00:00:00					
001	00:00:00:01	25.0	65			
002	00:00:00:20	85.0				
003	00:00:00:40	35.0				
004	00:00:01:00	65.0				
005	00:00:01:20	15.0		3	3	
006	00:00:01:40	25.0				
007	00:00:02:40	10.0				
008	00:00:02:20	25.0				
009	00:00:02:10	95.0				
010	00:00:04:00	25.0				

EFFECTS ON THE RUNNING TIMEBASE DISPLAY

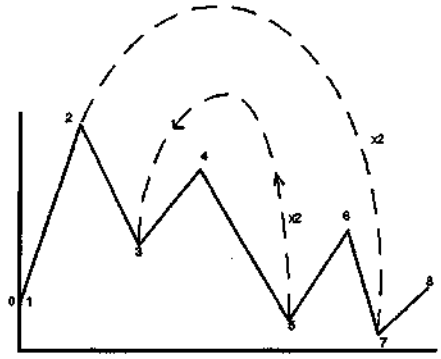
The timebase display in Monitor mode no longer counts up time from start of cycle after the system starts to loop. Once it passes the point from which it must loop back, it displays the time flow within each loop. Once it has finished looping it continues to count up time from the beginning of the last loop.

The need for calculation can be removed by changing the basis of timing to a segmental one, but it is no panacea. However, if you would like to explore this system variant please contact Service Dept or your dealer.

NESTED LOOPS

The following shows an example of the use of nested loops. When this program is run it causes the temperature to return to 25°C (point 8 in the diagram) at 9 minutes 40 seconds after the start of the cycle, not at 2 minutes 20 seconds as listed.

Seg	Time	Temp	Hum	LS	Rep	Digital Channels
	dd:hh:mm:ss	°C				
000	00:00:00:00					
001	00:00:00:01	25.0	65			
002	00:00:00:20	85.0				
003	00:00:00:40	35.0				
004	00:00:01:00	65.0				
005	00:00:01:20	15.0		3	2	(2 reps + original)
006	00:00:01:40	45.0				
007	00:00:02:40	5.0		2	2	(2 reps + original)
008	00:00:02:20	25.0	65			



CALCULATION FOR SUCCEEDING EVENTS

event statement time = event actual time - total looping time

The "total looping time" is the time to execute the loops as defined by LS & Rep.

In the above example it comprises:

(segment 2 is the first segment looped back TO)

(segment 5 is the first segment looped back FROM)

time from segment 2 to segment 5	= 1:20	60 seconds
loop 1 from 5 to 3		
time from 3 to 5		40 seconds
loop 2 from 5 to 3		
time from 3 to 7		80 seconds
loop A from 7 to 2		
time from 2 to 5		60 seconds
loop 1a from 5 to 3		
time from 3 to 5		40 seconds
loop 2a from 5 to 3		
time from 3 to 7		80 seconds
loop B from 7 to 2		
time from 2 to 5		60 seconds
loop 1b from 5 to 3		
time from 3 to 5		40 seconds
loop 2b from 5 to 3		
time from 3 to 5		40 seconds
	total	500 seconds (7:20)

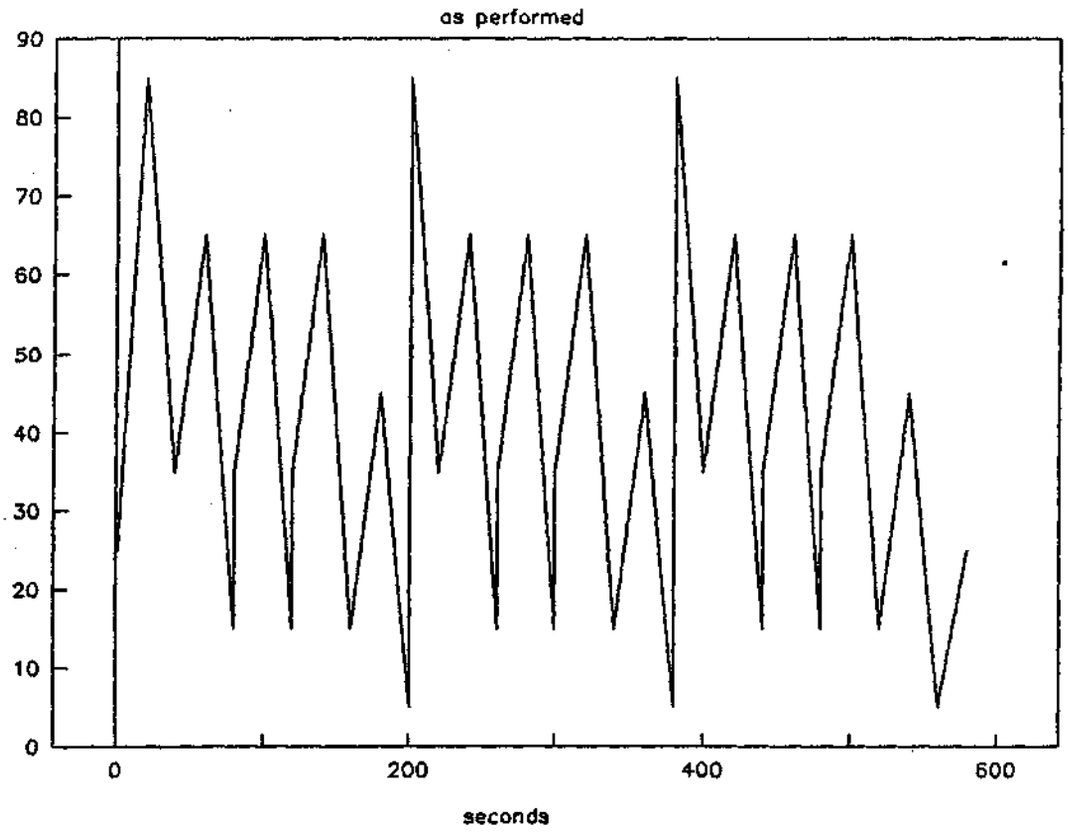
Because in the above example it is required to end the cycle at 9:40, then:

- event statement time = 9:40 - 7:20 = 2:20

Point 8 must be programmed at 540 seconds (9 minutes 40 seconds) from the start of the cycle, and point 7 at 9 minutes 20 seconds.

The figure below shows the whole program listing as performed.

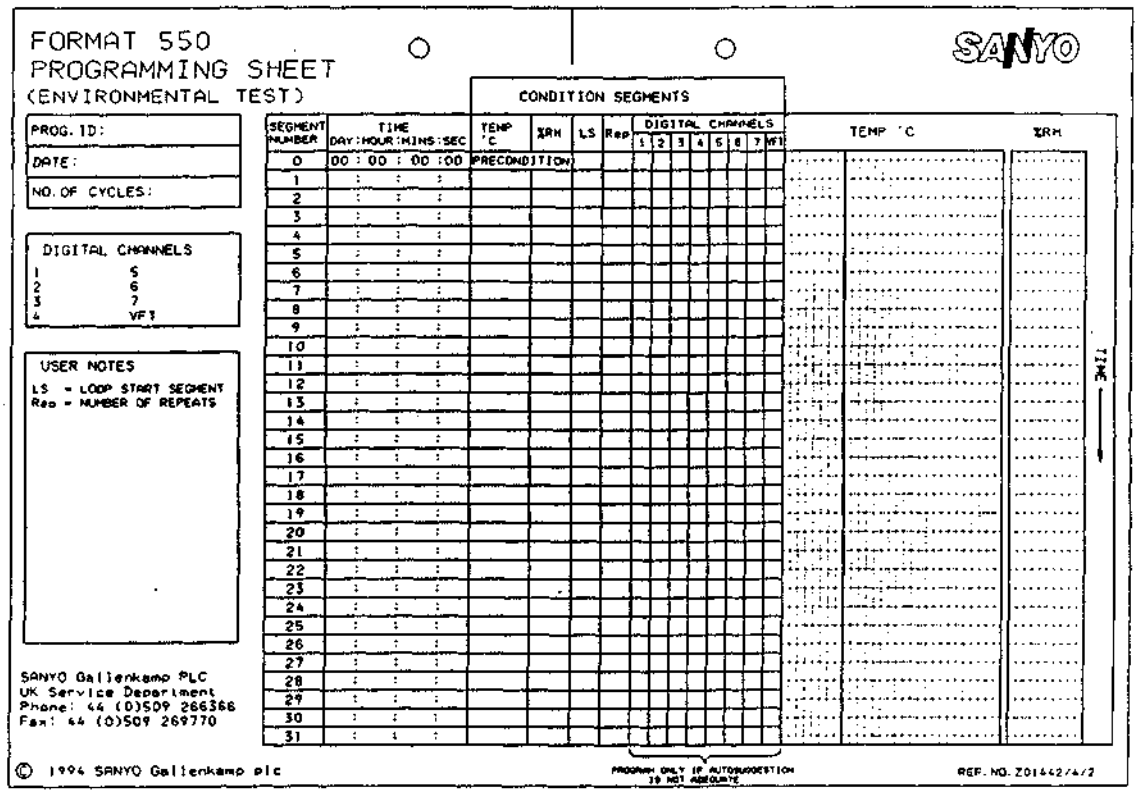
EXAMPLE OF NESTED LOOPS



EXAMPLE OF NESTED LOOPS

PROGRAM AS LISTED					PROGRAM AS PERFORMED			
time	temp	rh	LS	Rep	seconds	temp	time display	elapsed time
dd:hh:mm:ss							dd:hh:mm:ss	dd:hh:mm:ss
00:00:00:00	25	65			1	25	00:00:00:01	00:00:00:01
00:00:00:01	25				20	85	00:00:00:20	00:00:00:20
00:00:00:20	85				40	35	00:00:00:40	00:00:00:40
00:00:00:40	35				60	65	00:00:01:00	00:00:01:00
00:00:01:00	65				80	15 loop to 3	00:00:01:20	00:00:01:20
00:00:01:20	15		3	2	80	35	00:00:00:40	00:00:01:20
00:00:01:40	45				100	65	00:00:01:00	00:00:01:40
00:00:02:00	5		2	2	120	15 loop to 3	00:00:01:20	00:00:02:00
00:00:02:20	25	65			120	35	00:00:00:40	00:00:02:00
					140	65	00:00:01:00	00:00:02:20
					160	15	00:00:01:20	00:00:02:40
					180	45	00:00:01:40	00:00:03:00
					200	5 loop to 2	00:00:02:00	00:00:03:20
					200	85	00:00:00:20	00:00:03:20
					220	35	00:00:00:40	00:00:03:40
					240	65	00:00:01:00	00:00:04:00
					260	15 loop to 3	00:00:01:20	00:00:04:20
					260	35	00:00:00:40	00:00:04:20
					280	65	00:00:01:00	00:00:04:40
					300	15 loop to 3	00:00:01:20	00:00:05:00
					300	35	00:00:00:40	00:00:05:00
					320	65	00:00:01:00	00:00:05:20
					340	15	00:00:01:20	00:00:05:40
					360	45	00:00:01:40	00:00:06:00
					380	5 loop to 2	00:00:02:00	00:00:06:20
					380	85	00:00:00:20	00:00:06:20
					400	35	00:00:00:40	00:00:06:40
					420	65	00:00:01:00	00:00:07:00
					440	15 loop to 3	00:00:01:20	00:00:07:20
					440	35	00:00:00:40	00:00:07:20
					460	65	00:00:01:00	00:00:07:40
					480	15 loop to 3	00:00:01:20	00:00:08:00
					480	35	00:00:00:40	00:00:08:00
					500	65	00:00:01:00	00:00:08:20
					520	35	00:00:01:20	00:00:08:40
					540	45	00:00:01:40	00:00:09:00
					560	5	00:00:01:00	00:00:09:20
					580	25	00:00:02:20	00:00:09:40

APPENDIX 3 - FORMAT 550 PROGRAMMING SHEETS



FORMAT 550
PROGRAMMING SHEET
(ENVIRONMENTAL TEST)

SANYO

PROG. ID:
DATE:
NO. OF CYCLES:

DIGITAL CHANNELS
1 5
2 6
3 7
4 VFI

USER NOTES
LS = LOOP START SEGMENT
Rep = NUMBER OF REPEATS

CONDITION SEGMENTS

SEGMENT NUMBER	TIME DAY:HOUR:MINS:SEC	TEMP °C	%RH	LS	Rep	DIGITAL CHANNELS 1	2	3	4	5	6	7	VFI
0	00 : 00 : 00 :00	PRECONDITION											
1	: : :												
2	: : :												
3	: : :												
4	: : :												
5	: : :												
6	: : :												
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31	: : :												

PROGRAM ONLY IF AUTOSUGGESTION IS NOT ADEQUATE

TEMP °C

%RH

TIME

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